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Vol. 6. 1915. No. 4.

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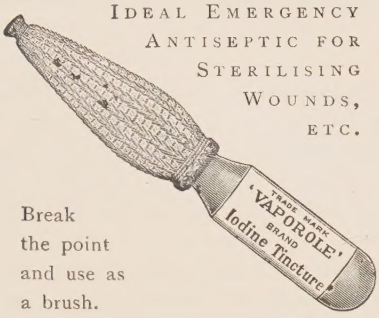

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

Vol. 6.] 1915. [No. 4.

PROTOZOOLOGY.

FANTHAM (H. B.). **Insect Flagellates and the Evolution of Disease, with Remarks on the Importance of Comparative Methods in the Study of Protozoology.**—*Ann. Trop. Med. & Parasit.* 1915. June 30. Vol. 9. No. 2. pp. 335–348.

The present paper deals with the great need for the use of comparative methods in the study of protozoology, especially as applied to disease, and for more attention to be paid to the biological evolution of disease producing agents. "For this study a knowledge of comparative morphology and of the inferences to be made therefrom is absolutely essential." The misapplication of energy in destructive, speculative and irrelevant criticism and controversy based, as it usually is, on incomplete knowledge on the part of the critics, is deplored. At the same time, "legitimate criticism is always welcome, but when it degenerates into mere retort and negation, it is subversive of progress." The lack of a broad comparative outlook on the part of many critics has resulted in sterility occurring, where fertility should have been assured, had the problems been attacked from a wider standpoint. The problems relating to human leishmaniasis serve as a striking illustration.

The author discusses fully the significance of the herpetomonad stage of Leishmania. It is shown how the discovery of the flagellate stage of *Leishmania donovani* in cultures by ROGERS, and of the root of the flagellum in *L. donovani* by CHRISTOPHERS, in *L. tropica* by MESNIL and colleagues and in *L. infantum* by NOVY, coupled with the knowledge of the life cycle of a herpetomonad given by PATTON, should have led early to experiments on the evolution of the diseases due to these parasites. It is also recalled that ROGERS, in 1905, gave a far-seeing warning that preventive measures should be instituted against probable insect carriers of leishmaniasis, even if absolute proof had not been obtained.

The existence of herpetomonad stages of Leishmania (especially of *L. tropica*) in man, as recorded by ESCOMEL, MONGE, LA CAVA and SPLENDORE is discussed, and also the occurrence of flagellate stages of *Histoplasma capsulatum* as described by DARLING, but overlooked or ignored by certain workers who desire to prove it a yeast. The herpetomonad parasite of man, *Haemocystozoon brasiliense*, also is noted. This collection of examples is sufficient to demonstrate the existence of flagellate herpetomonad parasites in man.

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That herpetomonads occur naturally in other vertebrates is also shown. Dutton and Todd's early finds of herpetomonads in mice in Senegambia, and those of the author and colleague in mice in England, suffice to prove this point. There is thus afforded evidence for the statement that "it is highly probable that the so-called herpetomonad stages of trypanosomes were really cultures of scanty herpetomonad infections coexisting with trypanosome infections."

A slight but necessary diversion is made to draw attention to the recent wrong use of the term Leptomonas for herpetomonads, and to the lack of precise knowledge of the so-called type species of this so-called genus.

Plants also suffer from "flagellosis" due to a flagellate parasite, *Herpetomonas* (*Leptomonas*) *davidi*, which occurs in them and in Hemiptera which infest them and which serve as the transmitters of the malady.

Experimental evidence that flagellates normally parasitic in insects can live, multiply within and become pathogenic to vertebrates, when fed or inoculated to them, is given. The work of Laveran and Franchini in France and of Fantham and Porter in England in this connection is cited in some detail. These experiments show plainly "leishmaniasis in the making," and point the way to preventive measures in connection with kala azar and allied diseases, the only practical attempts on these lines having been made by Dodds Price and Rogers in Assam, with considerable success.

The author's summary is as follows :—

"The significance of the herpetomonad stage of *Leishmania*, of the recent announcements that such stages occur in man, and of the presence of natural herpetomonads in other vertebrates (for example, mice), are discussed. It also recalled that insect herpetomonads can invade and live in plant-tissues.

"The experiments on the introduction into different vertebrates of various species of *Herpetomonas* and *Crithidia* parasitic in insects by Laveran and Franchini, using mammals, and by Fantham and Porter, using both warm- and cold-blooded vertebrates, are summarised and discussed.

"It is inferred that the various leishmaniases are due to a herpetomonad of invertebrates which, under different conditions of environment, produces pathogenic effects in very varying degrees in different vertebrates, from zero, as in the mice described by Dutton and Todd in 1903, to high mortality as in Indian kala-azar, and probably zero again in cold-blooded hosts. It is also a flagellate which can probably live in invertebrates not already recorded as being infected. A human reservoir of leishmaniasis may occur in some places, while warm- and cold-blooded vertebrates may also function as the same.

"It is highly probable that the so-called cultural herpetomonad stages of trypanosomes were really cultures of scanty herpetomonad infections co-existing with trypanosome infections.

"It is recalled that Rogers in 1905 published that "it is worth while to discuss which are the most probable kinds [of insect transmitters of kala azar] in order that precautions may be taken against them without waiting for absolute proof to be obtained." Although these remarks were published ten years ago, little has been done directly in the way of the preventive measures suggested. A notable exception, however, is the work of Dodds Price in Assam."

W. Yorke.

Fantham (H. B.) & Porter (Annie). **Further Experimental Researches on Insect Flagellates introduced into Vertebrates.**—*Proc. Cambridge Philosoph. Soc.* 1915. June 14. Vol. 18. Pt. 3. pp. 137–148.

The present paper contains an account of the continuation and extension of the work previously done by the authors in experimentally introducing into vertebrates flagellates belonging to the genera Herpetomonas and Crithidia, which live naturally in the digestive tracts of insects [see this *Bulletin*, Vol. 5, pp. 280–282.] Flagellates from sanguivorous and non-sanguivorous insects have now been used, and the vertebrate hosts now include representatives of most of the great groups.

"The flagellates used in this research include *Herpetomonas jaculum* (Léger) parasitic in the gut of the Hemipteran, *Nepa cinerea*; *H. stratiomyiae* (Fantham and Porter) from the digestive tract of the larva of the Dipteran, *Stratiomyia chameleon*; *H. pediculi* (Fantham) from the gut of the body-louse, *Pediculus vestimenti*; and *Crithidia gerridis* (Patton) from the alimentary tract of the Hemipteran, *Gerris paludum*. It will be seen that some of these insect hosts are blood-suckers, while others are not.

"The vertebrate hosts included sticklebacks (*Gasterosteus aculeatus*) among the Pisces; newts (*Molge vulgaris*), frogs (*Rana temporaria*) and toads (*Bufo vulgaris*) among the Amphibia; lizards (*Lacerta vivipara*) and a grass-snake (*Tropidonotus natrix*) among the Reptilia, and mice (*Mus musculus*) among the Mammals.

"The insect flagellates were introduced into the vertebrates by inoculation or by feeding. No ectoparasites and no haematozoa were present on or in the vertebrate hosts at the commencement of the researches."

Full records are given of seventeen experiments on the introduction of the above-mentioned flagellates into 2 sticklebacks, 2 frogs, 2 toads, 1 newt, 3 lizards, 1 grass snake and 6 mice. "The work is necessarily prolonged and tedious, as some of the animals used live for months, and consequently relatively few experimental vertebrates can be managed and observed at any one time." The introduced protozoa were pathogenic to the mammals but not markedly so to the cold-blooded vertebrates. *Herpetomonas jaculum*, *H. stratiomyiae*, *H. pediculi* and *Crithidia gerridis* proved pathogenic to mice. Frogs became infected with *H. jaculum* and *C. gerridis*, sticklebacks, toads and grass snakes with *H. jaculum* and lizards with *C. gerridis*. Second and third passages of some of the parasites were obtained. Thus, a mouse became infected by feeding on the liver of another that had died from infection with *H. pediculi* from human body lice. Similarly, a lizard died after infection with *Crithidia gerridis*. A second lizard fed on the liver of the first, also contracted the infection, and a third one, inoculated with the heart blood of the second, showed leishmaniform parasites. Thus, three passages of the parasite have been accomplished.

Control vertebrates were kept in each case. They remained healthy and unparasitised, and lived longer than the experimental animals.

The parasites, whether Herpetomonas or Crithidia, were present in the vertebrate hosts in either the non-flagellate or the flagellate form, or usually both. They were more abundant in the internal organs of the host, particularly in the liver, spleen and bone-marrow. "The appearance and relative position of the blepharoplast in leishmaniform elements vary. It may be either bacilliform or dot-like in shape, and thus resembles that of *Leishmania tropica* more than that often

seen in *L. donovani*, though variations occur in all these parasites. *L. tropica* thus seems to have retained more of the variation seen in the original insect flagellate stock from which it was derived." In all experiments where *C. gerridis* was used, the parasite invariably retained the crithidial facies in the vertebrate host. No transition to a trypanosome was ever seen. It is noted that " infections obtained in the adult experimental animals were not heavy, thereby differing from those recorded in young animals in our previous paper. . . . Doubtless, the parasites are more virulent in young hosts, as is the case with Mediterranean kala azar in children."

The authors draw attention to the occurrence of herpetomonad stages of Leishmania in man, and to the observations of SERGENT, LEMAIRE and SENEVET on the presence of a herpetomonad flagellate in cultures of the blood and organs of geckos obtained from areas in Algeria in which oriental sore, due to *L. tropica*, is prevalent. Phlebotomus flies, which may harbour a natural herpetomonas, feed on the geckos and man. Hence, animals like geckos may act as reservoirs of leishmaniasis. The account given by LINDSAY of the possible interrelations of ticks or flies and rattlesnakes with human dermomucosal leishmaniasis in Paraguay, is also noted. Mice may be reservoirs of herpetomoniasis in nature, herpetomonads having been observed by DUTTON and TODD in 1903 in Senegambian mice, and subsequently by the present authors in mice in England [see below]. The experiments detailed in the present paper show that insect flagellates belonging to the genera Herpetomonas and Crithidia have produced infections not only in mammalian hosts like mice, but also in cold-blooded vertebrates belonging to the Pisces, Amphibia and Reptilia. Hence, there is the possibility of any of these animals acting as reservoirs, under suitable conditions.

The authors' conclusions are as follows :—

" 1. Herpetomoniasis can be induced in various warm- and cold-blooded vertebrates when the latter are inoculated or fed with herpetomonads occurring in the digestive tracts of various insects. The infection produced and the protozoal parasites found in the vertebrates resemble those of human and canine leishmaniases.

" 2. An infection can also be induced in certain vertebrates when they are fed or inoculated with *Crithidia gerridis*, and both flagellate and non-flagellate stages occur therein, but no transition to a trypanosome was found.

" 3. The following Flagellata have proved pathogenic to warm-blooded mammals when the latter have been fed, or inoculated subcutaneously or intraperitoneally with them—*Herpetomonas jaculum*, *H. stratiomyiae*, *H. pediculi* and *Crithidia gerridis*. The hosts used were mice of various ages. That *H. ctenocephali* can infect dogs has already been shown by us.

" 4. *Herpetomonas jaculum* and *Crithidia gerridis* have also been successfully fed or inoculated into cold-blooded hosts, namely, fishes (*Gasterosteus aculeatus*), frogs, toads, lizards (*Lacerta vivipara*) and grass-snakes (*Tropidonotus natrix*).

" 5. As we have previously stated, we believe that leishmaniases are arthropod-borne herpetomoniases, and that these maladies have been evolved from flagellates of invertebrates (especially herpetomonads of insects), which have been able to adapt themselves to life in vertebrates.

" 6. In areas where leishmaniases are endemic, an examination should be made of all insects and other invertebrates likely to come into contact with men or dogs or rats and mice, in order to ascertain if these invertebrates harbour herpetomonads. Preventive measures should be directed against such invertebrates, especially arthropods. Further, it is likely

that certain vertebrates, such as reptiles and amphibia (especially those that are insectivorous), may serve as reservoirs for leishmaniases or, as they should preferably be termed, herpetomoniases. From such reservoirs the herpetomonads may reach man by the agency of ectoparasites or flies, especially such as are sanguivorous."

W. Y.

Fantham (H. B.) & Porter (Annie). **On the Natural Occurrence of Herpetomonads (Leptomonads) in Mice.**—*Parasitology.* 1915. June. Vol. 8. No. 1. pp. 128–132. With 7 text figs.

The authors recall their discovery in 1909, in Cambridge, of herpetomonads in the blood of mice. The infection was scanty and the parasites were examined in the fresh state and stained *intra vitam*. The flagellates were also seen in 1911 and 1912, but again the infections were scanty.

The herpetomonads measured 11μ to 18μ in length by 3μ to 4μ in maximum breadth, and were uniflagellate. The movements of the organisms are described. Partial formation of the non-flagellate, leishmaniform stage was sometimes seen in life. The mice were kept in laboratories where rats and rat-fleas, *Ceratophyllus fasciatus* and *Ctenophthalmus agyrtes*, were present. It is very likely that the former flea was infected with *Herpetomonas pattoni*, as such fleas in England are known to harbour scanty infections of this flagellate.

The authors refer to their previous and other researches on the introduction of insect flagellates into vertebrates [see this *Bulletin*, Vol. v, pp. 280–282, and above.] They also refer at length to the interesting remarks of Dutton and Todd* (1903) on the natural infection of house mice with herpetomonads at McCarthy Island, Gambia River.

The authors' conclusions are :—

"(1). That natural herpetomonads (or leptomonads) occur in mice.

"(2). That the origin of the infection is to be sought in a flagellate of an ectoparasite of the mouse. This flagellate is very probably *Herpetomonas pattoni*, a natural or specific parasite of fleas (especially rat fleas), which protozoön can adapt itself to life in the blood of mice.

"(3). Herpetomonads have been recorded from rat fleas, dog fleas and human fleas. Probably the flagellates are varieties of one species, *H. pattoni*, which can live in the blood and certain internal organs of rats, mice, dogs and man."

The paper is illustrated by 7 text-figures.

W. Y.

Franchini (G.) & Mantovani (M.). **Infection expérimentale du rat et de la souris par** *Herpetomonas muscae domesticae.*—*Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 109–111.

The authors have conducted successful experiments with *Herpetomonas muscae domesticae* obtained from flies in Bologna and neighbourhood. The flies captured on farms were parasitised to the extent of 3 per cent., but those caught in houses were never infected. Various flagellate forms were seen, but non-flagellate stages were rare.

*See *Liverpool Sch. Trop. Med., Memoir* xi, pp. 56–57.

Six rats were inoculated intraperitoneally with the gut-contents of heavily infected flies. Three rats died of peritonitis, and the three remaining ones became infected with Herpetomonas. Protocols of the latter are given, and may be summarised thus :—

One rat lived 80 days, though it became thin. Non-flagellate parasites occurred in the spleen and bone-marrow. The second rat was killed 108 days after inoculation, while still in good health. Leishmaniform and uninucleate rounded parasites were seen in the spleen, bone-marrow, and liver. One flagellate form had been seen previously in a blood smear. The third rat was killed after 65 days, when ill. Elongate, leishmaniform parasites were seen in the spleen, bone-marrow and liver.

Other rats were inoculated intraperitoneally with the blood or emulsion of organs from infected rats, and themselves became infected. Protocols of five are given. All showed leishmaniform parasites.

Another rat was fed on a 12 days' old culture of *Herpetomonas muscae domesticae* containing various stages of the parasite. When the rat was killed two and a half months later, it showed a few leishmaniform elements in the liver, spleen and bone-marrow.

A culture on a Novy-glucose medium of the heart blood of one of the first infected rats showed, after 12 days, Anaplasma-like organisms. Two mice inoculated intraperitoneally therewith showed a few leishmaniform parasites in the liver at autopsy. Attempts at sub-cultures failed.

All the experimental animals were free from fleas, and contained no blood parasites, when examined at the commencement of the researches.

H. B. Fantham.

Laveran (A.) & Franchini (G.). **Au sujet d'un Herpetomonas de *Ctenopsylla musculi* et de sa culture.**—*Bull. Soc. Path. Exot.* 1915. May. Vol. 8. No. 5. pp. 266–270.

The authors have succeeded in obtaining a pure culture of a new Herpetomonas, *H. ctenopsyllae*, parasitic in the digestive tract of the mouse flea, *Ctenopsylla musculi*. Fleas frequently contain few bacteria in their alimentary canals.

Herpetomonas ctenopsyllae in the mouse flea shows leishmaniform stages, the smallest of which measure 2μ to 4μ by 1μ. These elements are oval and non-flagellate, each usually containing a nucleus and a blepharoplast. They are often arranged in rosettes. There are also elongate non-flagellate forms, measuring 5μ to 15μ by 1·5μ to 2μ, with one end rounded and the other drawn out. Flagellate forms are rare with short flagella. Dividing parasites are common. Encysted stages were not seen in the flea faeces.

The Herpetomonas of the mouse flea is considered to be a new species because of the rarity of the flagellate forms and the shortness of the flagellum. [It is very doubtful whether these are valid criteria for founding a new species.]

For the purposes of culture, the fleas were killed with ether or xylol vapour. They were then washed a dozen times in sterile salt solution. The food canals were removed aseptically and placed in the liquid of condensation of simplified Novy medium. The cultures were kept

at 25° to 26° C. Six tubes of rabbit-blood-agar medium were so prepared. Of these, four became contaminated with fungi and bacteria, one remained sterile and one gave a pure culture of the Herpetomonas. This culture five days after sowing was negative, but on the ninth day showed a very few immobile rounded parasites and on the 14th day contained elongate parasites, often arranged in rosettes and exhibiting slow movements, but staining badly after fixation. Sub-cultures were made and in eight to ten days gave pure cultures of *H. ctenopsyllae*. Third and fourth passages were successfully obtained, and the preparations therefrom stained well. The blood-agar should be freshly prepared for use.

In cultures, non-flagellate elements, 4μ to 6μ by 1μ, were found either singly or in rosettes, and some were in process of division. There were also elongate parasites measuring 7μ to 20μ by 2μ. Some cultures contain spherical, non-flagellate forms about 5μ in diameter. Flagellate forms were relatively rare and measured up to 20μ by 1μ.

The authors propose to inoculate these cultural herpetomonads into mammals.

H. B. F.

Brug (S. L.). *Herpetomonas homalomyiae*, **n. sp.**—*Arch. f. Protistenkunde.* 1914. Nov. 3. Vol. 35. No. 2. pp. 119–126. With 1 plate.

The author gives an account of *Herpetomonas homalomyiae*, parasitic in the alimentary tract of the larvae of *Homalomyia scalaris*. The observations were commenced in November 1913 and extended to 1914. Parasites were most abundant at the commencement of the winter and dwindled later. The larvae died before pupation. The herpetomonads were almost entirely limited to the main gut, and were rare in the Malpighian tubules.

The full grown flagellate has an elongate body. It is about 26μ by 3μ, the flagellum being as long as the body. The organism is uniflagellate. Biflagellate forms are in process of division. The flagellum arises from near the blepharoplast and a granule [basal granule] is at its origin. The nucleus is oval and is centrally situated, the blepharoplast is round or oval and the protoplasm is usually homogeneous.

The cysts or postflagellate forms are distinctive. They are 3μ to 4·5μ by 5μ to 6·5μ. Each usually contains a nucleus, blepharoplast and chromidia. At encystment, the body curves, the flagellum is withdrawn and bends round from the blepharoplast, forming a loop in the cytoplasm.

Multiplication is by longitudinal division. The author believes that the flagellum of the parent does not divide, but that one of the daughter organisms produces a new flagellum. Multiple division was seen once only, and division rosettes were never observed. The encysted forms showed no division.

The author reiterates Patton's opinion that pre- and post-flagellate stages as well as the fully grown flagellate form must be taken into full consideration before giving specific rank to any flagellate. He also follows Patton's diagnosis of the genus Herpetomonas.

The paper is illustrated by a plate of 40 figures.

H. B. F.

Rodhain (J.). **Herpetomonas parasites de larves d'Oestrides cavicoles.** —*Bull. Soc. Path. Exot.* 1915. June. Vol. 8. No. 6. pp. 369–372. With 1 plate.

Herpetomonads were found in the digestive tubes of the larvae of cavicolous Oestridae living in the antelope, *Bubalis lelwel jacksoni*, from the plain of Ouellé, to the north of Doungou, Belgian Congo, and in *Potamochaerus porcus*, a river hog from the forest to the south of Ouellé, near Bambili.

(i). Herpetomonas from larvae living in Bubalis. The parasites, as seen in life, are large, lanceolate organisms each with a thick anterior flagellum. The length of the body is 30μ to 45μ, and the breadth is 3·5μ to 6·25μ. In stained preparations the body is seen to be slightly acuminate posteriorly, and its greatest breadth is a little anterior to the nucleus. The blepharoplast and nucleus are in the position usual to herpetomonads. The intracellular, basal portion (or rhizoplast) of the flagellum is thick and arises from a basal granule. The flagellum s surrounded by a thin, periplastic membrane. Rhizoplast and flagellum are always double, even when the parasite is at rest. The author considers that two axostyles occur in the cytoplasm in the form of thin, chromatophile filaments, extending from the rhizoplasts to the posterior end of the body, and crossing one another in front of and behind the nucleus. Cysts of the flagellate were not seen, but forms in process of encystment were found on the surface of the mucosa lining the frontal sinus of the host.

Five species of Oestridae were found in the frontal sinus of the Bubalis. They were *Oestrus aureo-argentatus*, *O. bertrandi*, *Gedoelstia paradoxa*, *Kirkia* sp., and *K. minuta*. The larvae of all five Oestrids were found to be infected, but the adult flies were not parasitised.

(ii). Herpetomonas of larvae of *Rhinoestrus nivarleti* living in *Potamochaerus porcus*. Six larvae found on the same river hog were all infected with a herpetomonad allied to the preceding, but a little smaller with a little less distinct double flagellum. Forms in process of encystment were seen. The haemocoelic fluid of the larvae was not infected. Precocious division of the flagellar apparatus in the adult parasites gives rise to forms which are really bi-flagellate. The author assigns the flagellate of Oestridae provisionally to *Herpetomonas muscae domesticae*.

Subcutaneous inoculation of a young guinea-pig with the flagellate was negative.

H. B. F.

Mackinnon (Doris L.). **Studies on Parasitic Protozoa. III (a). Notes on the Flagellate Embadomonas. (b.) The Multiplication Cysts of a Trichomastigine.**—*Quart. Jl. Microscop. Sci.* 1915. Vol. 61. Pt. 1. (New Ser. No. 241). pp. 105–118. With 1 plate.

The first part of this paper is occupied with a further description and emendation of the genus Embadomonas, created by the author in 1911 for a slipper-shaped flagellate found in the intestine of trichopterous larvae. Another species has since been found in the intestine of the crane fly. The new diagnosis of the genus Embadomonas is as follows :—

"This genus contains small slipper-shaped flagellates, characterised by

a very large cytostome bordered by prominent lips, which are more or less siderophilous, and two flagella, not so long as the body, one acting as an organ of locomotion, and the other lying in the cytostome; the spherical nucleus is placed at the anterior end of the body; the two basal granules, from which rise the flagella, lie at the anterior border of the cytostome. There is a definite periplast, which prevents deformation of the body. The anterior part of the body shows a well-marked torsion. The cysts are relatively small, and are ovoid in form."

"As 'species characters' may be used: (1) The form of the body; (2) the nature of the periplast; (3) the degree of development of the cytostome and its lips; (4) the size of the cysts."

A full diagnosis of *Embadomonas agilis* and of *E. alexeieffi* is then given. The author points out that in the original diagnosis of the genus Embadomonas it was described as uniflagellate.

A detailed account of the division of *Embadomonas alexeieffi* and some notes on the encystment of these flagellates follows, and the section closes with a discussion of the affinities of the genera of the Chilomastigines.

The second section of the paper contains an account of division phenomena in the cysts of a trichomastigine, either *Trichomastix trichopterorum* or *Tetratrichomastix parisii*, from tipulid larvae. The parasite forms almost spherical cysts of 4μ to 5μ diameter. "Within the cyst the flagella may persist as dark coiled lines lying superficially in the cytoplasm." Complicated changes occur in the nucleus and basal granules, consequent on which new axostyles are produced as well as new nuclei. Some of the parental flagella seem to persist, others are regrown. "There is no trace of any sexual process."

H. B. F.

Schultz (C. H.). **Coccidiosis in Cattle and Carabaos.**—*Jl. Infect. Dis.* 1915. July. Vol. 17. No. 1. pp. 95–108.

The paper deals in a somewhat diffuse and discursive manner with coccidiosis in cattle and carabaos in the Philippine Islands, where rinderpest is common. The author's attention was attracted to the investigation of irregular or atypical cases of apparent rinderpest. Some of these animals were found to be suffering from acute or chronic coccidian gastro-enteritis. He thinks that some of the swampy pastures and water holes were contaminated. The faeces of infected animals were diarrhoeic or dysenteric. The animals suffering from coccidiosis lived longer than those infected with rinderpest, but gradually became weaker and lost flesh, exhibiting symptoms of dysentery and slow cachexia, but not acute toxaemia. Lesions typical of a severe gastro-intestinal disturbance, due to asexual multiplication of Coccidia in different parts of the intestine, were found. The author lays stress upon a fact, which should be already well known, that Coccidia "produce dangerous dysentery only during their asexual multiplication" when merozoites may be passed in the faeces.

Rinderpest and coccidiosis are often associated and difficult to separate clinically. The former was detected by a sero-diagnostic test of the urine, while the latter may be diagnosed by the microscope. A survey of the literature relating to coccidiosis in cattle is given but the causal agent is said to be *Stiedia eimeria*—a very inaccurate

rendering of *Eimeria stiedae*. An incomplete and somewhat misleading account of the life-cycle is outlined. It is thought that some stages of the life-cycle may be passed in the blood system. Montgomery's statements regarding the differentiation of rinderpest and coccidiosis are quoted, namely, that rinderpest can be transmitted by blood inoculation while coccidiosis cannot be so transmitted. Animals immune to rinderpest have been observed, in many cases, to be periodic carriers of Coccidia. It is concluded that coccidiosis has an extensive distribution throughout the Philippine Islands.

H. B. F.

Stevenson (A. C.). *Klossiella muris.—Quart. Jl. Microscop. Sci.* 1915. Vol. 61. Pt. 1. (New Ser. No. 241). pp. 127–135. With 1 plate.

The author gives a brief resumé of the literature relating to *Klossiella muris* and then an account of the forms of the parasite as observed by him in the urinary system of white mice. Twenty-five white mice were examined and 40 per cent. were infected. What were possibly the youngest forms of *K. muris* observed were small, gregariniform bodies about 12μ long, but the nature of these is somewhat doubtful, as the author states that they may have been merozoites of the intestinal coccidium of the mouse. The next stage is found in the arterioles of the kidneys. The round parasite is endothelial, about 8μ in diameter and contains three nuclei in process of division. Two types of schizogony have been seen. The first occurred in one case only, wherein parasites containing 8 to 12 daughter forms, each with a well-marked karyosomatic nucleus, were found in an endothelial cell of the arteriole. The second form of schizogony usually took place in "cells forming the capillaries in the glomeruli of the kidneys." On five occasions in all, it has also been seen in the endothelial cells of the arterioles. Fifty to sixty daughter forms are produced. Each of these daughter organisms is gregariniform, and has "a nuclear area containing two small masses of chromatin and some residual protoplasm." These merozoites are liberated by the bursting of the host cell into the Bowman's capsule and pass into the cells of the convoluted portion of the tubule in "the condition of gametocytes or gametes" according to the author's belief.

The next stage is "somewhat difficult to interpret." The author considers that "the normal condition is a double infection of the cells, the two individuals being at first indistinguishable from one another." Single infections are also found. The author discusses the two types of syngamy that may occur, and concludes that whatever it may be, "there is no doubt that fusion or association of the two gametocytes takes place," and that this is followed by nuclear division until 12 to 16 peripherally arranged nuclei are present. "The nuclei gradually travel outside the line of general contour of the parasite and along with some of the cytoplasm are finally budded off one by one." The nuclei in these buds or sporoblasts then divide, enlargement occurs, a cyst wall forms around each sporoblast and a spherical body containing about 25 nuclei, each consisting of 3 grains of chromatin arranged in a line, is produced. Thus, "a spore cyst containing about twenty-five sporozoites with a certain amount of residual matter at one pole of the cyst" is formed. The capsule bursts, and the spores pass down the tubules, through the papillae and ureter to the bladder.

The concluding section of the paper consists of speculations as to a possible connection of *Klossiella muris* with the Leucocytogregarine of the mouse, and whether Klossiella is a link between the haemogregarines and the coccidia. Both, as shown by the number of phases it is necessary " to presuppose " are very problematic.

The author considers that the possibility of *Klossiella muris* being a parasite of the arteries gives it a special interest from the medical point of view. A plate of 38 figures illustrates the paper.

H. B. F.

Gonder (Richard). **Zur Uebertragung von *Haemoproteus columbae*.—** *Arch. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3. pp. 316–323.

The experiments detailed in this paper were made at the Veterinary Institute, Onderstepoort, Transvaal, South Africa, in 1910. The previous researches of the brothers Sergent and Aragão are discussed and confirmed. Like these workers, the author found " cysts " of *Haemoproteus columbae* in the lungs of pigeons and also discovered them in the liver.

The invertebrate host of the Haemoproteus in South Africa is the fly, *Lynchia olfersia capensis*. Gametes and oökinetes are formed in the digestive tract of the Hippoboscid fly. The oökinetes get rid of their pigment and are then in a condition to be inoculated back into the pigeon. The parasites in the pigeon are taken up by the leucocytes, and find their way to the lung or liver. The infected leucocytes in these organs become greatly hypertrophied, as schizogony of the Haemosporidian takes place within them. The merozoites enter red blood corpuscles and become gametocytes in the peripheral blood of the bird.

By experiments, the author found the incubation period to be from 23 to 30 days. The development in the Lynchia was not found to progress beyond the oökinete stage, nor did the fly show hereditary infection. The infected flies lose their infectivity if fed on clean pigeons, but so long as oökinetes are present in the stomachs of the Lynchia, they are capable of transmitting the parasite. The Lynchia are not immune against reinfection.

Pigeons cannot be infected by direct blood inoculation. However, if blood is placed in a moist chamber and oökinetes allowed to form, then infection occurs if this cooled oökinete-containing blood is inoculated. Direct infection is also possible by the inoculation of parasitised lung emulsion.

H. B. F.

Adie (Helen). **The Sporogony of *Haemoproteus columbae*.—*Indian Jl. Med. Research.*** 1915. Jan. Vol. 2. No. 3. pp. 671–680. With 3 plates.

The Haemosporidian parasite, *Haemoproteus* (*Halteridium*) *columbae*, is transmitted from pigeon to pigeon at Ambala, India, by the Hippoboscid fly, *Lynchia maura*. The author's researches were conducted at Kasauli from mid-June to the end of September 1914, and the flies were brought from Ambala. There is a " succession of events " in the Lynchia including " the oökinete, the zygote, the bursting oöcyst

setting free sporozoites, and vast numbers of sporozoites in the salivary glands." There was no evidence of regurgitation of parasites. An account is given of the alimentary tract of the Lynchia.

Oökinetes are found "a few hours after the fly has fed on a pigeon with flagellating parasites." Zygotes are often seen in the lower portion of the mid-gut not far from the Malpighian tubes. They vary in size, according to growth, from 7·2μ by 8·2μ up to oöcysts 36·5μ by 36·4μ. The pigment in them consists of roundish (not rod-shaped) particles. "The zygotes resemble those of *Proteosoma* and malaria, but they seem to be smaller." The sporozoites measure from 7μ to 10μ in length.

Details are given of infection and transmission experiments.

The conclusions are as follows :—

"1. Pigeons at the places and the times indicated are very heavily infected with *Haemoproteus*; no other blood parasites were found.

"2. *Lynchia* flies associated with these pigeons are also very heavily infected with the sexual stages of a parasite analogous to *Proteosoma* and *Malaria*. Where flies are rare, pigeon infection is also rare. Kasauli pigeons show no flies and are, as far as my experience goes, free from infection.

"3. The development of *Haemoproteus* can be traced in the fly; the oökinete, zygote, oöcyst, and sporozoite stages have all been demonstrated. Sporozoites have been seen in vast numbers in the salivary glands and streaming down the salivary duct.

"4. Both sexes of *Lynchia* carry the infection.

"5. Laboratory bred flies placed on infected birds have shown in due course both zygotes and sporozoites of the same type as those of naturally infected flies.

"6. Kasauli pigeons for good reasons thought to be uninfected (but not laboratory hatched) have become infected by flies taken off heavily infected Ambala birds (flies afterwards dissected and found infected).

"7. The sporogony of *Haemoproteus* in this *Lynchia* is similar to that of *Proteosoma* and the malaria parasite. It is another instance of the cycle of Ross."

A "Mallophagus" was found on the Lynchia which fed on the latter, and apparently nourished itself on pigeon's blood taken from Lynchia.

[It is to be regretted that the author gives no drawings of the stages of the Protozoön in the Lynchia. Only the oökinete stage was formerly known therein. The illustrations accompanying the paper are entomological and are very diagrammatic.]

H. B. F.

Carpano (Matteo). **Sul Ciclo Evolutivo dell'*Haemoproteus Danilewskyi*, Note Morfologiche e Biologiche del Parassita riscontrato in alcune Specie di Uccelli della Colonia Eritrea.**—[Cycle of Development of *H. danilewskyi*, Morphological and Biological Notes of the Parasite met with in Birds of Eritrea.] *Studi di Med. Trop.* 1914. Vol. 1. pp. 129–148. With 7 text figs. and 2 coloured plates.

The author, working in the Italian colony of Eritrea on the Red Sea, examined 327 birds during a period of about four years. The birds found to be parasitised with *Haemoproteus danilewskyi* were magpies, desert partridges, Serpentarii and owls. The infected birds appeared normal, though at post-mortem their spleens were found to be enlarged,

pigmented and pulpy, with dilated blood-vessels. The liver and bone-marrow were also pigmented. There was a slight rise of temperature (about 1° C.) every seven to eight days.

The schizogony and gametogony of the Haemosporidian are described and figured in detail. Regarding schizogony, the author's results confirm those of Celli and Sanfelice (1891) and Labbé (1894). Two types of *Haemoproteus danilewskyi* were found, namely, type A in the owl and Serpentarius and type B in the magpie and desert partridge. The schizonts of type A are larger, more regular and more active than those of type B. Merozoite formation in type A is nearly always bipolar and regular, with the production of numerous (25 to 50) daughter forms. In type B unipolar formation of merozoites is more common and 15 to 25 are produced. The pigment in type A is fine and greenish in colour, while in type B it is rather coarser and brownish-yellow. The effect of the parasites on the erythrocytes in type B is rather more marked than in type A, with production of stippling resembling Schüffner's dots but staining blue with Romanowsky solution.

The author describes new gametocytic forms which he calls schizontigametes. They are stated to be somewhat different morphologically from ordinary gametes but to have the same function. The difference is said to be best seen in the microgametocytes (male schizontigametes) in that they retain the chromatinic granulation of the original schizonts.

The chief points in the author's conclusions may be rendered thus :—

(1). The magpie (*Coracias abyssinicus*), the desert partridge (*Caccabis petrosa*), the Serpentarius (*Gypogeranus serpentarius*), the owl (*Bubo lacteus*), birds inhabiting the colony of Eritrea, were found to be infected with *Haemoproteus danilewskyi.*

(2). The infection, as determined by alterations seen in the red blood cells and in the internal organs, produces no especial clinical symptoms, though the parasite is allied to that of human malaria.

(3). The Haemoproteus is found in all parts of the colony and at altitudes up to 2,500 metres. It is more abundant in basal regions up to 1,500 metres, where protozoal infections of men and animals are more common.

(4). The parasite is transmitted by species of Culex, namely, *C. pipiens, C. annulatus* and *C. fatigans.*

(5). The Haemoproteus lives within the red blood cells of the avian host and produces haemozoin, but the host cells are not markedly altered, though some of them show stippling comparable with Schüffner's dots.

(6). In the peripheral blood of the host there occur young forms, schizonts and merozoites, as well as sexual forms or gametocytes (♂ and ♀). When endoglobular, the latter are at first reniform and then become round. In some preparations schizonts predominate.

(7). Schizogony usually occurs at the two poles of the parasite, rarely at one only.

(8). Schaudinn's account of the schizogony of the Haemoproteus in *Athene noctua* is not confirmed.

(9). In blood kept in a moist chamber it was possible to observe the initial phases of sporogony, as well as the liberation of merozoites from host cells. Also, schizogonic forms in process of transformation to gametocytes (macrogametes and microgametocytes being formed

from merozoites), and schizontigametes were seen. Gametes were found to preponderate.

(10). The schizontigametes, seen by the author for the first time, differ slightly in morphology from ordinary gametes but behave as such. They are apparently destined for the conservation of the species.

(11). *Haemoproteus danilewskyi* was found in different birds. The author distinguishes two types of the parasite.

(12). Transmission by blood-inoculation from bird to bird of the same or different species has so far been unsuccessful.

H. B. F.

WENYON (C. M.). **The Pigmented Parasites of Cold-Blooded Animals, with some Notes on a Plasmodium of the Trinidad Iguana.**—*Jl. Trop. Med. & Hyg.* 1915. June 15. Vol. 18. No. 12. pp. 133–140. With 1 plate.

The author commences with a historical survey of the pigmented parasites of cold-blooded vertebrates. These protozoa were first seen by SIMOND in 1901, who found melanin-containing organisms in the red blood corpuscles in the Indian river tortoise, *Trionyx indicus*. SIMOND called the parasite *Haemamoeba metchnikowi*.

These pigmented parasites may be placed in two main genera: "Firstly, the genus Plasmodium, which includes parasites which go through the schizogony stage in the red blood corpuscles and produce gametocytes in these cells too; secondly, the genus Haemoproteus, including parasites which do not reproduce by schizogony in the red blood corpuscles, which cells only contain the gametocytes in varying stages of growth."

"A great difficulty of this classification is the fact that in certain instances of evident infection with a parasite of the genus Plasmodium, gametocytes alone may be present in the peripheral blood for considerable periods." The parasites of cold-blooded vertebrates, more especially of reptiles, agree in these respects with those of birds.

A detailed and illustrated account is given of a blood parasite of the Trinidad iguana, *I. sapidissima*. The youngest stages of the parasite are minute and are often situated at one pole of the erythrocyte. They increase in size, are irregular in shape, and form a few grains of brown pigment. During schizogony four merozoites are produced and these may be arranged crosswise, in the form of a semicircle, in the shape of a fan or in a cone-like manner. Gametocytes also were seen. Pigmented leucocytes occurred. The author considers that the parasite of the iguana must be included with that of the Brazilian lizard, *Mabuia agilis* in one species under the name, *Plasmodium minasense* (Carini and Rudolph, 1912).

The author considers that "two observations are exceedingly important in giving descriptions of these parasites." The first is that slight variations in staining reaction are of little value. The second is that the degree of alteration of the host erythrocyte depends largely on the interval of time elapsing between the death of the animal and the making of the blood films.

Brief descriptions are then given of the pigment-containing Haemosporidia occurring in lizards, chelonians and snakes. The parasites of lizards include *Plasmodium simondi* Castellani and Willey, 1904,

from *Hemidactylus leschenaulti*; *Plasmodium agamae* Wenyon, 1908, from *Agama colonorum*; *Plasmodium mabuiae* Wenyon, 1908, from *Mabuia quinquitaeniata*; *Plasmodium tropiduri* Aragão and Neiva, 1909, from *Tropidurus torquatus*; *Plasmodium diploglossi* Aragão and Neiva, 1909, from the *Diploglossus fasciatus*; *Plasmodium minasense* Carini and Rudolphi, 1912, from *Mabuia agilis* and *Iguana sapidissima*.

The parasites of Cheloniidae include *Haemoproteus metchnikowi* Simond, 1901, from *Trionyx indicus*; *Haemoproteus cajali* Pittaluga, 1912, from *Clemmys africana*; *Haemoproteus roumei* Bouet, 1909, from *Cinixys belliana*; *Haemoproteus testudinis* Laveran, 1905, from *Testudo pardalis*; *Haemoproteus chelonidae* Johnston and Cleland, 1909, from *Chelodina longicollis*; *C. oblonga* and *Emydura krefftii*: *Haemoproteus sp.*, Plimmer, 1912, from various Cheloniidae which had died in the Zoological Society's Gardens in London.

The parasites of snakes apparently belong to one species, *Haemoproteus mesnili* Bouet, 1909, from various species of Naja and Sepedon.

H. B. F.

França (C.). **Quelques observations sur le genre Leucocytozoon.**—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 229–241.

The paper is divided into three sections, dealing respectively with the nature of the host cells, schizogony and the generic characters of Leucocytozoon.

The author notes the two different shapes of host cells already recorded for these parasites of avian blood, namely, those with fusiform prolongations and those which are rounded and without such prolongations. He briefly summarises [sometimes insufficiently for exactness] the views of previous workers on the nature of the host cell. These opinions incline to one or more of the following types of cell, erythroblast, mononuclear leucocyte and erythrocyte. He has studied *L. mathisi*, parasite of *Accipiter nisus* and *L. mirandae*, parasite of *Merula merula*. The former produces horn-like deformation of its host cells, the latter has no such effect. Very young birds were studied; they are stated to have been free from other haemocytozoan infections.

The two Leucocytozoa under investigation are said to be parasites of erythrocytes, whose action on the red blood cells is very rapid and very intense.

The young leucocytozoon of *Merula merula*, as it enters the host cell, is rod-like, recalling certain forms of Theileria, its length being 1μ. The parasite becomes pyriform, with its nucleus at the broader end and measures 1·5μ to 2·2μ. The host cell now appears to be poor in haemoglobin. The leucocytozoon then becomes rounded and its nucleus central, the body diameter being 2·8μ to 3μ. The host cells are now so altered that it is difficult to recognise them. The haemoglobin has almost disappeared and the nuclei of the erythrocytes are hypertrophied. The parasite is now rounded, and the host erythrocyte has lost its characters, its nucleus acting as an envelope to the parasite.

L. mathisi has similarly been shown to be a parasite of the red cells of its host.

The rounded form of host cell is considered to be due to two factors, the round shape of the gametocytes of the parasite, and precocious vacuolisation of the cytoplasm of the red cell invaded. The elongate and drawn out type of host cell is discussed and the movements and behaviour of the parasite within it is somewhat vaguely noted. It is concluded that it is the form of the parasite which determines that of the host cell.

Regarding schizogony, the work of FANTHAM, who first found schizogony in avian Leucocytozoa, MOLDOVAN, COLES and the author is reviewed. This phase takes place in the internal organs of the host, such as the spleen and the lungs.

The name Leucocytozoon was first used by DANILEWSKY in 1889, but it was ZIEMANN in 1898 who first established the genus. The parasites belonging thereto exhibit sexual dimorphism, and only gametocytes occur in the peripheral blood. They do not form pigment except *L. majoris*, which does so in some cases. The genus Leucocytozoon belongs to the family Haemamoebidae of the order Haemosporidia.

In a discussion, LAVERAN prefers the name Haemamoeba to Leucocytozoon. He considers that the type species is *L. ziemanni* (Laveran) and not *L. danilewskyi* (Ziemann).

[Regarding the author's remark that the form of the parasite determines the shape of the host cell, he appears to have overlooked the work of FANTHAM (1910) on this subject, who wrote :—" Personally, I have seen the spindle or horn-like ends of the host cell of *L. lovati* elongate during the movements of the parasite within it. . . . This (spindle shape) is probably due to a deformity of the cells brought about by the movements of the parasite within. . . . The shape of the host-cell of different Leucocytozoa may be merely a reflex of the motility of the parasite within." The movements of avian Leucocytozoa are described in detail in FANTHAM'S memoir. (*Proc. Zool. Soc.*, Lond., 1910, p. 694). With regard to the systematic position of the Leucocytozoa, FANTHAM (1910), when describing the full schizogony of *L. lovati*, commented on the systematic position of the parasites as follows :—" The avian Leucocytozoa are typical members of the Haemosporidia, allied to the malarial parasites." (*Annals Trop. Med. & Parasitol.*, Vol. 4, p. 258).]

H. B. F.

WICKWARE (A. B.). **Is *Leucocytozoon anatis* the Cause of a New Disease in Ducks?** —*Parasitology*. 1915. June. Vol. 8. No. 1 pp. 17–21. With 3 plates.

Numerous outbreaks of disease among ducks having occurred in the district around Ottawa, the author investigated an outbreak at a poultry farm, where heavy mortality had prevailed. The ducks had been dying at the rate of 20 per day for a few days, then there "appeared to be a remission for about a ten day period" with a recurrence at the end of this when "fatalities would again be enormous."

The malady often ran a rapid and fatal course. The prodromal symptoms were very slight, lack of appetite being the most noticeable. Some died in the first attack, others after several exacerbations.

The birds lie in a semi-comatose condition but, if aroused, undergo remarkable contortions of the head and body. Their power of controlling equilibrium is lost, so that they fall about. In the majority of recovered birds, there is difficulty of locomotion, and the ducks are stunted and undersized. The mortality is 65 to 70 per cent.

Fly larvae were at first thought to be the cause, but they were found in a few sub-acute cases only. Microscopical examination of cerebro-spinal fluid, peritoneal exudate, etc. showed nothing. Cultures were not possible under the conditions of work. However, Leucocytozoa (*L. anatis*) were found in large numbers in ducks in which the infection ran an acute and fatal course. Smears of the spleen also showed an abundance of parasites. The predominant type of Leucocytozoon was spindle-shaped, 35μ to 60μ by 10μ. It possessed an oval, elongate or irregularly shaped nucleus, with a dark, chromatic band extending along one edge.

Transmission experiments by intraperitoneal inoculation of clean ducks, three weeks' old, were performed. On the seventh day, two "gamete forms" were noted in one of the ducks. Three days later, typical gamete forms appeared. They persisted a few days, and then disappeared.

In conclusion, the author states: "That the Leucocytozoön above described is the causative agent of this disease, we are not prepared to say." He gives reasons for it probably being the excitant, and for the failure to transmit the parasite. Two coloured plates of the parasite and one of photographs of the diseased ducks, illustrate the paper.

H. B. F.

Knuth (P.). **Ueber Piroplasmen bei europäischen Rindern mit besonderer Berucksichtigung ihrer Aetiologie.** [Piroplasmosis in European Cattle and its Aetiology].—*Arch. f. Schiffs- u. Trop.-Hyg.* 1915. May. Vol. 19. No. 9. pp. 245–267.

This paper is a review, containing an account, largely historical, geographical and etiological, of European piroplasmosis in cattle. The author describes *Piroplasma bigeminum* and *P. divergens*. He mentions the ticks responsible for the spread of piroplasmosis and the names of other ticks occurring in the regions where piroplasmosis is known. The part played by *Ixodes ricinus* in the spread of *P. bigeminum* is discussed. The author considers that *Haemaphysalis punctata* seu *cinnabarina* is responsible, together with *Ixodes ricinus*, for the transmission of *P. divergens*, which is the piroplasm found in some cattle in Great Britain as well as in others on parts of the Continent bordering on the North Sea. *P. divergens* is not very virulent.

The anatomical and pathological changes occurring in piroplasmoses in European cattle are discussed. Details regarding the association of a number of cases of splenic rupture with piroplasmosis are given. In such cases Anaplasma-like bodies were not found, although search was made for them. That few cattle die from European piroplasmosis is considered to be probably due to relatively few ticks being infected, while there is the possibility of young cattle acquiring immunity.

In conclusion, the author gives a short account of measures for combating European piroplasmosis in cattle. Protective blood inoculation of stock on the one hand, and tick destruction on the other, are recommended.

[A well illustrated account of piroplasmosis, considered from a much wider point of view, will be found in *Parasitology* (1913), Vol. 6, pp. 302–320. This account, more easily accessible to British workers, forms one of the Herter Lectures given by Professor Nuttall.

H. B. F.

Carini (A.) & Maciel (J.). **Sobre a molestia dos Cães, chamada Nambi-Uvú e o seu Parasita** (*Rangelia vitalii*). [On a disease of Dogs called Nambi-Uvú and its Parasite].—*Annaes Paulistas de Medicina e Cirurgia.* 1914. Sept. Vol. 3. No. 3. pp. 65–71. With 9 text figures.

There occurs in Brazil a disease of dogs (especially among hunting dogs) called nambi-uvú, which means bleeding from the ears. It is also known as "yellow fever of dogs," being marked by malignant jaundice or icterus. It was recorded by Carini in 1908 and carefully described by Bruno Rangel Pestana in 1910. The latter investigator ascribed the disease to a piroplasm, which he named *P. vitalii*. The disease may occur at any time during the year, but more frequently in the summer, especially among dogs after a hunt.

Three forms of the disease may be distinguished :—

1. Acute or icteric, with intermittent fever and temperatures up to 38°·5 to 40° C, and usually fatal.
2. Sub-acute or haemorrhagic, characterised especially by cutaneous capillary haemorrhages on the ears or back.
3. Chronic, with progressive wasting but no characteristic symptoms, usually ending in recovery.

The disease is experimentally transmissible by blood inoculation, and young dogs are more susceptible than adults. The latter, when successfully inoculated, usually exhibit the chronic form of the disease. The incubation period varies, being about 3 days, 8 to 15 days, and 18 to 25 days respectively in the three forms of the disease. In nature the sub-acute form is most frequently observed, but is not so common among experimentally infected animals. Regarding diagnosis, it should be noted that in the chronic form the parasite may not be found in the peripheral blood. Bile pigment may occur in the urine, but there is no characteristic lesion. The pathological anatomy and histology are described.

Regarding the causal agent of the disease the authors state that it differs from *Babesia canis* in multiplying by schizogony, as well as by binary fission. The unpigmented parasites occur in the red blood corpuscles. Young forms measure 2μ, older ones $3{\cdot}5\mu$ to $4{\cdot}5\mu$, and may be round, oval or pyriform with alveolar cytoplasm and round, compact, excentric nucleus. There is no blepharoplast. Two parasites may be found in a red corpuscle, but three, four or more may occur. Free parasites are observed in the internal organs, and schizogony occurs therein. No flagellate forms were seen.

The authors give some details of the schizogonic stages, which they regard as separating the parasite from true piroplasms. In schizogony thirty to fifty or even a hundred or more parasites may be observed in interstitial cells of tissues or in the endothelial cells of capillaries of the inner organs. Masses of merozoites may be 18μ to 25μ across and are seen in the kidneys, heart and lungs. The parasite is placed in a new genus *Rangelia*, in the Piroplasmidae.

Nuttall, who examined some of the preparations, called the authors' attention to resemblances between the parasite and *Rossiella rossi* of jackals. Attempts at culture were unsuccessful. The parasite may be transmitted by ticks. *Amblyomma cayennense* and *A. striatum* were found on some of the infected dogs. Parasites may still be found in dogs which have recovered and so a reservoir is maintained.

Trypanblue has been of service therapeutically in some cases. It was injected intravenously in 1 to 2 per cent. solution, in repeated doses of 10 to 20 cc.

The authors conclude that there exists in Brazil a grave, infectious disease of dogs, popularly known as nambi-uvú, characterised by jaundice and cutaneous and internal haemorrhages, caused by a parasite, *Rangelia vitalii*, belonging to the Piroplasmidae.

The paper is illustrated by 9 text-figures of the parasite.

H. B. F.

Priestley (Henry). *Theileria tachyglossi* (**N. sp.**). **A Blood Parasite of *Tachyglossus aculeatus*.**—*Ann. Trop. Med. & Parasit.* 1915. June 30. Vol. 9. No. 2. pp. 233–238. With 1 plate.

The author gives an account of a new Theileria, *T. tachyglossi*, found in the blood corpuscles of an Echidna, *Tachyglossus aculeatus*, from the neighbourhood of Townsville, Queensland. "In their morphological appearance the parasites resembled closely *Theileria parva* of East Coast Fever." Bacilliform, ovoid, pyriform, round and comma-shaped parasites were seen, as well as transitional forms. The bacilliform parasites measured 1·8μ to 3·0μ by 0·3μ to 0·8μ. The comma forms were 2μ to 3μ long, and 0·8μ to 1·2μ broad. The ovoid and pyriform ones were 1μ to 3μ by 0·5μ to 1·2μ, and no sharp line of distinction could be made between these two types. Rounded forms were the least common. They measured 1·0μ to 2·2μ in diameter. Koch's bodies occurred in small numbers in the peripheral blood and in large numbers in organ smears, particularly in the liver, spleen and lungs. They were either free or included in leucocytes or endothelial cells; they probably represent stages of asexual multiplication of the parasite. A coloured plate of 16 figures illustrates the paper.

H. B. F.

Dias (Ezequiel Caetano) & Aragão (Henrique de Beaurepaire). **Pesquizas sobre a Natureza dos Anaplasmas.** (On the Nature of Anaplasmata.) [Also in German].—*Mem. Inst. Oswaldo Cruz.* 1914. Vol. 6. No. 3. pp. 231–249. With 2 plates.

The first part of this memoir is devoted to a historical survey of the bodies which are termed Anaplasma. Certain authors consider that

Anaplasma is organismal and associate it with such diseases as "gall-sickness," while others have produced similar structures in the blood by the use of various reagents. The bodies, sometimes known as marginal points, are coccus-like and measure 0·1μ to 0·5μ in diameter.

The authors conducted a number of experiments on animals such as guinea-pigs, rabbits, dogs and cattle by inoculating them with phenylhydrazine, nitrobenzol, pyrogallic acid, saponin, phosphorus in oil emulsion and trypanblue. Saponin and phosphorus oil emulsion gave no interesting results, even when administered by the mouth. The authors produced Anaplasma-like bodies in rabbits, guinea-pigs, dogs and rats in 48 hours by inoculating haemolytic substances. Degenerative appearances of the red cells such as basophilia, polychromatophilia, anisocytosis, nucleated red cells, poikilocytosis, etc. were seen together with bodies having the characters applied by Theiler to Anaplasma. They compared the structures thus produced with preparations of natural Anaplasmata obtained from Theiler and others. The staining reactions, size, morphology, lack of structure and pseudo-division forms were the same in bovines naturally infected with anaplasmosis as in those animals in which anaemia had been artificially induced.

Rabbits, guinea-pigs and dogs were the most suitable animals for these experiments, and the most useful reagents were nitrobenzol, pyrogallic acid and phenylhydrazine. Pyrogallic acid was administered in doses of 0·1 cc per kilogram weight of the animal, the other two drugs were administered in various doses from 0·01 cc. to 0·1 cc. Care must be taken to regulate the dose according to the powers of resistance of the animal. Anaplasmata have been found in the blood of animals infected with worms and in those newly born. Their presence in worm-infected animals is due to the haemolytic action of the helminthic toxines, and in very young animals to the activity of the haematopoietic organs.

The anaplasmosis of Brazil is considered to be really a piroplasmosis, in which the protozoan parasites remain chiefly in the internal organs of the host. It is concluded that Anaplasmata are not parasitic organisms, as has also been stated previously by others. The haemolytic action of trypanblue injected intravenously has been found to result in the earlier appearance of Anaplasmata in the blood. It has been stated that Anaplasma has a long incubation period up to 24 days in nature.

In their conclusions the authors emphasise that Anaplasma is not a Protozoon, but is a product of the degeneration of the red cells. It results from certain anaemic conditions produced by various haemolytic toxines. Anaplasmosis is not a true disease, the cases so described being a clinical form of piroplasmosis.

Protocols of the experiments are appended. The two plates illustrate natural and experimentally induced Anaplasmata.

H. B. F.

Veglia (Francesco). **Coltura dell' *Anaplasma Marginale* in vitro. Nota preliminare.**—*Giorn. R. Accad. Med. di Torino.* 1915. Jan.-Feb. Vol. 78. No. 1–2. pp. 33–39.

The paper contains the early results of the author's researches on the culture of *Anaplasma marginale*, performed in Pretoria in the

laboratory of Theiler. The culture media tried were defibrinated blood of an infected animal, sodium chloride, sodium chloride and sodium citrate (according to the formula of Carpano for the culture of *Nuttallia equi*). and ordinary broth. Defibrinated blood and Carpano's medium were most successful.

The following results were obtained with Carpano's medium :— A culture of the first series in three days showed an increase in infected blood corpuscles from 8 per cent. to 25 per cent. A culture of the third series in 20 days showed an increase in infected corpuscles from 7 per cent. to 20 per cent. and in 40 days to 25 per cent. A culture of the fourth series with an average of 17 per cent. of infected corpuscles gradually rose in 21 days to 30 per cent. A culture of the fifth series commencing with an infection of 1 to 2 per cent. of the blood corpuscles oscillated between 4 and 8 per cent. for three weeks and then rose rapidly to 20 per cent. in the next three days. A culture of the sixth series, which was from a weak strain, showed in 15 days a rise in infected corpuscles from 0·5 per cent. to 5 per cent. In a culture of the tenth series, the infection rose from 6 per cent. to 20 per cent. of the corpuscles in 8 days.

The results with a medium of defibrinated blood were :—A culture of the third series showed an increase in infected corpuscles from 16 per cent. to 24 per cent. in 4 days. A culture of the tenth series showed a percentage increase from 6 to 15 in the course of 8 days. After 5 days, a culture of the twelfth series showed an increase in the infected corpuscles from 3 to 11 per cent.

Cultures were incubated at 7° C., 15° C. and 25° C., though the author states that such differences of temperature do not exercise any marked effect on the increase in numbers of the parasite.

The addition of infected defibrinated blood to the defibrinated blood of an imported bovine recently immunised against anaplasmosis was unfavourable to the development of the culture of Anaplasma. Control cultures, made from the blood of normal cows and sheep were observed.

Regarding morphology, the author states that at the lower temperatures the predominating form was round. Later, these parasites became larger, somewhat irregular and elongate, with a triangular or quadrangular shape. The author thinks that the schizogonic cycle lasts 3 to 4 days The triangular and quadrangular forms give rise to 3 and 4 merozoites respectively. Diplococcoid forms are also known, and large schizonts dividing into eight have also been found. Bacterial infection of the cultures was in some cases a serious obstacle. A mixed infection of Anaplasma and *Babesia bigemina* in culture showed an increase in the number of Anaplasma but the Babesia gradually died out.

The principal points in the author's conclusions are :—Anaplasma grows and reproduces in artificial media. Defibrinated blood and Carpano's medium (sodium chloride and sodium citrate) have proved the most successful. Basophile granulations and Jolly's corpuscles behave in a very different way from Anaplasma in these media ; they do not increase in number but exhibit degenerative characters. In cultures of Anaplasma or of mixtures of Anaplasma and Babesia no transitional forms between the two organisms were seen. The blood of normal animals mixed with infected blood provides a good culture

medium, but the blood of an animal recently cured of anaplasmosis, mixed with infected blood, appears to inhibit the development of Anaplasma. It seems possible to cultivate Anaplasma taken from an infected animal during the incubation period. The progress of Anaplasma in culture is along the same general lines as in an infected animal.

H. B. F.

Sangiorgi (Giuseppe). *Toxoplasma ratti*, n. sp.—*Giorn. R. Accad. Med. di Torino.* 1914. Nov.-Dec. Vol. 77. No. 11–12. pp. 383–385.

The author gives a brief statement of the various Toxoplasmata already recorded, and adds to the list a new species, *Toxoplasma ratti*. He found this parasite in a lung smear of a white rat, *Mus rattus albinus*. Many of the elements observed were crescentic and all were uninucleate, measuring 6·4μ by 2·4μ. Division forms were not observed. Cardiac blood and bone-marrow were negative.

H. B. F.

Brug (S. L.). *Octosporea monospora* (Chatton u. Krempf). —*Arch. f. Protistenkunde.* 1914. Nov. 3. Vol. 35. No. 2. pp. 127–138. With 2 plates and 2 figs.

The author examined a number of the larvae of *Homalomyia scalaris* in November 1913, all being infected with *Octosporea monospora*, belonging to the Microsporidia. Larvae examined from February 1914 were less infected. Brug considers that it is certain that this parasite of *Homalomyia scalaris* is identical with the *Octosporea monospora* of *Drosophila confusa* and *D. plurilineata*.

The parasite is present in the gut epithelium of the larvae, or can live unharmed in the lumen of the gut. The meronts are rounded, with a compact nucleus. Dividing meronts show one to four aggregations of darker staining granules in the nucleus. Uninucleate meronts measure 4μ to 5μ. The meronts multiply by binary fission. Multinucleate forms result from delayed protoplasmic cleavage.

At spore formation, the meronts become curved, and are then sporonts. One sporont gives rise to one spore only. The spores are characteristic, elongate, curved or sickle-like in form. In many of the spores the nucleus is rod-shaped and is situated obliquely in the body. Striations parallel to the axis of the spore occur at one pole of the spore. Various chromatic structures present in the spore are described. No polar filament has been seen so far.

Two plates of 66 figures and 2 text-figures illustrate the paper. [The spores are somewhat like those of Sarcosporidia.]

H. B. F.

Darling (S. T.). **Sarcosporidia encountered in Panama.**—*Jl. of Parasit.* 1915. Mar. Vol. 1. No. 3. pp. 113–120. With 5 figs.

The author has examined nearly one thousand animals in the course of routine work at Ancon, Panama Canal Zone. Sarcosporidia were seen in three new hosts, namely, opossum, hawk and sloth. The following animals were also found to be infected with Sarcosporidia

namely, horse, cow, hog, sheep, cat, man and rats, *Mus rattus* and *Mus norvegicus*. The infection is common, but it does not seem to be markedly pathogenic.

The author then briefly describes a number of Sarcosporidia from various hosts, including a sarcocyst of the hawk, *Leucopternis* sp.; a sarcocyst of the sloth, *Cholœpus didactylus*; a sarcocyst of the opossum, *Didelphis* sp., in the voluntary muscles and heart and in such non-muscular tissue as lungs and sub-maxillary gland; and a sarcocyst from a vagrant cat.

The sarcocysts found in the biceps of a young negro are of interest:—

"Examination disclosed small sarcocysts one-third to one-half the diameter of the muscle fiber, distended with vesicular sporoblasts. The parasite was of the minute or abortive type such as Negri and I have found in guinea-pigs fed with sarcocysts from the rat and differed from those described from the laryngeal muscle of a man by Baraban and St. Remy in that the latter were much larger, possessed sporoblastic chambers, and were of a more mature type. Four months after the parasite had been detected, another examination of tissue showed that apparently they had entirely disappeared."

Sarcocystis muris was found in 15 rats out of 131. *S. tenella* was observed in a pet lamb brought from Peru. *S. miescheriana* was found in hogs that had died of swine fever. *S. fusiformis* was seen in two cows and in beef from Argentina. *S. bertrami* was detected in an old mule from the United States.

In an interesting discussion the author wonders whether Sarcosporidia are Neosporidian parasites of invertebrates which have become "sidetracked" in the tissues of vertebrates.

H. B. F.

Moroff (Theodor.). **Zur Kenntnis der Sarkosporidien.**—*Arch. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3. pp. 256–315. With 4 plates and 2 text figs.

The author has had the opportunity of examining much Sarcosporidia material from the slaughterhouses of Vienna and Sofia. The oesophagus of buffaloes especially was used and Sarcosporidia from sheep, cattle, horses and pigs were also examined. The younger Miescher's tubes were found in the deeper parts of the oesophagus.

Like many other workers, the author considers that the external striated layer of the tubes is derived from the muscle fibre of the host. The young spores contain metachromatic granules which are not present in older ones. A polar capsule has not been seen, but a wrinkling on young spores may simulate one.

A long discussion as to the origin of the spores ("sickles") is given. The author thinks that Rainey's corpuscles are only spores seen in cross section, and that no sporoblast stage exists. A Miescher's tube in cross section shows an outer coarsely granular zone and an inner, finely granular matrix from which the spores differentiate. Two hypotheses as to their formation are put forward. In the first case, the inner zone forms spores, the outer continues its growth and division. The second opinion, held by the author, is that the growth of the spore zone arises from the apposition of new elements from the outer portion of the tube. The pansporoblasts are considered to become spores directly, the transition being very rapid and the processes involved somewhat variable.

A long argument, concerning the systematic position of the Sarcosporidia, concludes the paper, which is illustrated by four plates and two text-figures.

H. B. F.

Zschokke (E.). **Ein Rhinosporidium beim Pferd.** *Schweizer Arch. f. Tierheilkunde.*—1913. Dec. Vol. 55. No. 12. pp. 641–650. With 1 text fig.

The author briefly describes the structure of a nasal tumour found in a horse in South Africa in 1906. The tumour was round, and about the size of an egg. It was reddish and hard with a rougher outer surface. No pus was present. The swelling contained a Sporozoön parasite present in the submucosa of the septum nasi.

Microscopically, cysts of various sizes were seen. The smallest parasites were about as large as leucocytes. Many of the cysts measured 30μ to 40μ in diameter. A few reached 120μ to 150μ. The cysts possessed definite inner and outer walls, and were filled with round "sporocysts" lying in a faint-staining ground substance. Young "sporocysts" [pansporoblasts] were unicellular, older ones were 6μ to 8μ in diameter and contained four to six round spores or sporozoites.

Cysts emptied of their contents undergo leucocytic infiltration.

The parasite is considered to be a Rhinosporidium, allied to the parasite (*R. kinealyi*) described from the septum nasi of man in India by Minchin and Fantham in 1905*. The author mentions having seen a similar organism in a section of a conjunctival tumour from a Japanese. [Similar growths in man have already been described by Ingram† in India.]

A text-figure is given showing four stages of the equine parasite, and under the diagram is the name *Rhinosporidium equi*. A pore in the cyst wall is shown but not described.

[Rhinosporidium in man has also been found in the external auditory meatus by Beattie and on the penis by Ingram. The geographical distribution of the human parasite so far recorded is India, Ceylon, Tennessee and Argentina. Now that Rhinosporidium has been found in horses in South Africa, it would be advisable to search for it in man in that country, and to endeavour to determine its mode of transmission.]

H. B. F.

Tirumurti (T. S.). *Rhinosporidium kinealyi.—Practitioner.* 1911. Nov. Vol. 93. No. 5. pp. 704–719. With 3 plates.

The author gives a brief historical survey of previous work in India on *Rhinosporidium kinealyi*. He then reports upon fifteen cases of the occurrence of the parasite in the neighbourhood of Madras and the Malabar coast. Of these infections 8 were of the nature of nasal polypi, 3 were naso-pharyngeal growths, 3 others were on the conjunctiva, while the remaining one was a papillomatous growth of the penis, an illustration of which is given.

* *Quart. Jl. Microsc. Sci.*, vol. 49, p. 521.
† *Lancet*, 1910, Sept. 3, p. 726.

The clinical features of the rhinosporidial growths are set forth. In the nose they are soft, polypoid, papillomatous and very vascular. They resemble a raspberry and are "suggestive of the colour of Jumbulum fruit." "In one of the cases reported, the patient was able to draw into and blow out of the nose a mass of soft velvety deep red polypi." The removal of the growths is always difficult as they are very friable, and there is a tendency to severe bleeding. Even after previous cauterization, there is a tendency to recurrence.

The conjunctival polypi are similar in character and occur both on the bulbar and palpebral conjunctiva. The growth on the penis started near the urethral orifice, the tip of the penis "was enlarged to about the size of a baby's fist and presented a most peculiar cauliflower polypoid appearance." The meatus was in the middle of the growth and was dilated, and there was no pain and no difficulty in micturition. Irritation was first noticed at the meatus seven or eight years previously, and the growth was observed about two years after. This case has been described already by INGRAM in 1910.

In fresh specimens of polypi small white spots about the size of pin points are seen and these contain spherical cysts. In sections the mucous membrane is seen to be thrown into irregular folds. There is infiltration of the sub-epithelial tissue with leucocytes, and parasitic cysts are found therein. A pore occurs in the cysts and is best seen in those not quite fully grown. A brief illustrated account of the life-cycle is given, more especially based on the work of MINCHIN and FANTHAM* (1905) and of BEATTIE† (1906). The author considers that no intermediate host is necessary for the transmission of the parasite. He gives a diagram of what he supposes to be the life-cycle, but there are no new stages shown in it. Attempts at inoculation into guinea-pigs failed during a period of observation of two months. Attempts at culture also failed.

The author concludes that the nasal and conjunctival polypi are contracted "by direct inoculation through infected clothing, handkerchiefs, or the hands. The spores are discharged in the nasal secretion." The parasites are probably transmitted by the contaminative method. The case of a student is mentioned, who probably contracted rhinosporidiosis while living with an infected fellow student. The possibility of polypi occurring in "the mucous membrane of the mouth, anus and vagina" is noted. The cases recorded by the author occurred in males between the ages of 10 and 60 who were natives of India.

[*Rhinosporidium kinealyi* was first reported in India from Calcutta. It is a Sporozoön belonging to the sub-class Telosporidia, order Haplosporidia, as was shown by MINCHIN and FANTHAM (1905), and is a member of the sub-order Polysporulea created by RIDEWOOD and FANTHAM in 1907.

Regarding the author's remark that Rhinosporidium is likely to occur in the external auditory meatus, he appears to be unaware that BEATTIE‡ (1907) has already described the parasite from this situation. As to "Rhinosporidium being a misnomer," a generic name once given must stand.]

H. B. F.

* *Quart. Jl. Microsc. Sci.*, vol. 49, p. 521.
† *Jl. Path. & Bact.*, vol. 11, p. 270.
‡ *Brit. Med. Jl.*, 1907, Nov. 16, p. 1402.

Mesnil (F.). **Sur la position systématique des Hémosporidies.**—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 241–244.

The author considers the genera Plasmodium (including Laverania and Proteosoma) and Haemoproteus (Halteridium) to be very closely allied. It is thought that the genus Haemocystidium is too little known for its validity to be certain. The genus Leucocytozoön is a member of the Haemosporidia.

The grouping of the three families, Plasmodiidae (or Haemamoebidae), Haemogregarinidae and Piroplasmidae, in the order Haemosporidia is considered by the author to be no longer possible, because of the coccidian nature of the Haemogregarines. The Coccidia are divisible into the Adeleidea and the Eimeridea. The Haemogregarinidae are allied to the former, and the Plasmodiidae to the latter. The Piroplasmidae, until more is known of the life-cycle in the invertebrate host, cannot be more definitely placed.

The author considers the name Haemocytozoa to be preferable to that of Haemosporidia, which, he thinks, includes a heterogeneous assemblage with general characters in common with the Coccidia. The name Haemocytozoa, however, is not taxonomic but refers only to the habitat of the parasites.

Regarding the controversy as to the relative claims of the names Piroplasma and Babesia, the author, in a footnote, retains the former. He very wisely remarks that it is inadvisable to give the same name to any two Protists, notwithstanding that one may be animal and the other plant.

H. B. F.

Pick (Ernst P.) & Wasicky (R.). **Ueber die Wirkung des Papaverins und Emetins auf Protozoen.**—*Wien. Klin. Woch.* 1915. June 3. Vol. 28. No. 22. pp. 590–591.

This paper records a number of experiments made in Vienna on the action of solutions of various concentrations of quinine hydrochloride, emetine hydrochloride, papaverine hydrochloride, narcotine hydrochloride and morphine hydrochloride on certain Protozoa. The object of the research was to find a substitute for emetine, the latter being imported into Austria-Hungary from abroad.

The Protozoa experimentally treated were *Paramaecium caudatum*, *Colpidium colpoda* and freshwater amoebae. *Trypanosoma brucei* was also used. The method employed was the examination of coverslip, hanging drop and moist chamber preparations of the protozoa, mixed with definite concentrations of the drug under test. The strengths of the drug solutions were 1 per 100, 1,000, 10,000 and sometimes 1 per 50,000 and 100,000.

One per cent. solutions of the hydrochlorides of quinine, emetine and papaverine killed *Paramaecium caudatum*, *Colpidium colpoda* and the amoebae instantly. The maximum dilution of quinine hydrochloride that killed *Paramaecium caudatum* was 1 per 100,000, the time being 1 hour 29 minutes. The same dilution of emetine killed in 2 hours, while papaverine hydrochloride of 1 per 50,000 killed in 2 to 8 hours. Similarly, *Colpidium colpoda* was destroyed by a 1 per 50,000 solution of quinine in 2 hours, by the same strength solution of emetine in 2½ hours, while a corresponding solution of papaverine was

fatal in 3 hours. Freshwater amoebae treated with a solution of 1 per 10,000 of quinine, emetine and papaverine hydrochlorides were dead after 1, 5 and 2 hours respectively. Narcotine hydrochloride behaved like papaverine. Morphine hydrochloride in 1 per cent. solution had little or no effect even after 24 hours exposure.

Trypanosoma brucei was killed by a solution of 1 per cent. emetine hydrochloride in 15 minutes, while a similar solution of papaverine killed it in 3 to 7 minutes.

The author considers that his experiments show that emetine and papaverine have an intense poisonous action on the protozoa experimented upon. In some cases, papaverine was superior to emetine. Narcotine is similar to papaverine in its action. The isoquinoline derivatives of the opium alkaloids, papaverine and narcotine, are poisonous to protozoa, while the phenanthrene derivative, namely morphine, is free from such properties.

The author suggests that the treatment of amoebic dysentery and other protozoal diseases, such as balantidiasis, by papaverine has advantages over treatment by emetine, and the effects of emetine on the heart and bloodvessels may be avoided by using papaverine. Also, papaverine costs only about one-twentieth as much as emetine, and is not obtained from overseas. The concluding remark is a warning that there is no proof that papaverine will behave like emetine in the bodies of men and animals, but that its use might be tried in an outbreak of amoebic dysentery.

[The fallacy of testing drugs intended for use in amoebic dysentery on free-living ciliates, freshwater amoebae and *Trypanosoma brucei* observed in vitro is obvious. Ehrlich, among others, has warned investigators against generalisations based on laboratory experiments only, and the authors of this paper have repeated the warning, which, considering their material and methods, must be carefully borne in mind.]

H. B. F.

Kolmer (John A.). **A Method of transmitting Blood Parasites.**—*Jl. Infect. Dis.* 1915. Mar. Vol. 16. No. 2. pp. 311–312.

The author, while engaged on chemotherapeutic researches with white rats experimentally infected with various trypanosomes and spirochaetes, tried a new method for obtaining small quantities of blood for inoculating new hosts. By this technique, " sufficient blood is obtained from the heart in an aseptic manner to infect a large series of rats without killing or seriously injuring the stock or seed animal. For the purpose of propagating a strain of trypanosomes by infecting one or two rats at regular intervals, the method has been found likewise serviceable, as a small amount of blood may be obtained aseptically and at frequent intervals without injury to the stock animal. The seed rat is fastened to an operating board or held by a gloved assistant and the cardiac area determined by palpation."

The hair and skin over the cardiac area are sterilized by application of iodine. " A test tube of sterile 1 per cent. sodium citrate in normal salt solution is warmed by heating in a Bunsen flame and a sufficient amount drawn carefully into a sterile 1 or 2 cc. Record syringe, fitted with a medium-sized needle (No. 22), in such a manner as to

avoid contamination." The smaller syringe is used when few injections are to be made, the larger one when many rats are to be inoculated. The syringe is only partly filled with the citrate-salt solution, sufficient space being allowed for suction by withdrawal of the piston when the needle has been passed into the heart.

"The skin over the cardiac area is drawn taut by the forefinger and thumb of the left hand without touching the site of puncture and the needle quickly entered into the heart, directed slightly upwards and toward the spine. No attempt is made to enter any particular chamber of the heart. At once, blood flows into the syringe. The action may be facilitated by gentle suction, although usually this is not necessary. When sufficient blood is obtained the needle is quickly withdrawn, the contents of the syringe are mixed by gentle agitation, and the animal returned to the cage."

A dilution of blood equivalent in density to a 1 per cent. suspension of erythrocytes is used in the case of heavily infected animals, while a correspondingly heavier emulsion is prepared if the parasites are few in number in the seed rat.

"By this method the whole procedure is quickly conducted in a sterile manner and only in exceptional instances is the animal seriously injured or killed by the operation. It is important to use a sharp-pointed needle, and one not so large as to unnecessarily injure the heart and not so small as to hinder the flow of blood."

H. B. F.

MacNeal (Ward J.) & Schule (Paul A.). **An Efficient and Convenient Stain for Use in the General Examination of Blood Films.**—*Post Graduate.* 1913. Nov. 6 pp.

After remarking on the Romanowsky stain and the various modifications of it due to Leishman and to Giemsa, it is pointed out that MacNeal in 1906 showed that the ability of these stains to differentiate chromatin is due to the presence therein of both methylene azure and methylene violet. The combination of methylene azure with eosin seemed to decompose somewhat in alcohol, with oxidation of the latter, and deterioration. However, solutions of the four dyes, methylene blue, methylene azure, methylene violet and eosin in methyl alcohol were prepared and found to be satisfactory.

The present investigation concerned the advisability of making two permanent solutions, the one containing eosin, the other containing methylene blue and its derivatives. Methylene azure may be purchased under the name of Giemsa's "Azure 1." Crude methylene violet was obtained through Ernst Leitz.

Two stock solutions were prepared as follows :—

Solution A—

Eosin, water soluble, yellowish	1
Methylic alcohol, Merck's "Reagent"	500

The dye dissolves readily with a little shaking.

Solution B—

Methylene blue, medicinally pure	1
Methylene azure	0·20
Methylene violet, commercial	0·60
Methylic alcohol, Merck's "Reagent"	500·00

"The dyes are thoroughly rubbed up in a perfectly clean mortar with a few drops of the alcohol so as to form a homogeneous paste. This is then transferred to a bottle (capacity 500 cc.) and the mortar is carefully washed clean with successive portions of methylic alcohol, which are subsequently poured into the bottle. The remainder of the 500 cc. of methylic alcohol is added, the bottle thoroughly shaken, stoppered loosely and immersed in warm water (50 deg. C.) for a time and again thoroughly shaken. It is well to keep it in a warm place for a few days, shaking it at frequent intervals so as to separate the dyes from the insoluble residue and bring them completely into solution. Filtration is unnecessary. These solutions are kept in amber bottles in a dark place and remain in good condition for several months. Small equal portions (30 cc.) are mixed together to form the staining solution, which is then ready for immediate use and keeps well for a few weeks.

"The staining method is that described by Leishman and already too well known to require more than a hasty description. To a freshly made, thin, dry blood film one adds the staining solution, allows it to stand one minute, then dilutes with about an equal amount of distilled water and allows this resulting mixture to act 2 to 3 minutes, then washes in distilled water until the desired differentiation is reached, and dries the preparation between filter papers. If the preparation is to be mounted in balsam or in cedar oil it should be very thoroughly dried, best by standing for a day in the incubator before mounting."

The above formula has been tested by the authors for ten months, and has given them satisfaction in routine blood work.

H. B. F.

Russell (Frederick F.). **A Combined Staining Method for Malarial Parasites and Blood Smears.**—*Jl. Amer. Med. Assoc.* 1915. June 26. Vol. 64. No. 26. pp. 2131–2132.

The author discusses the relative merits of Manson's borax methylene blue and the various modifications of the Romanowsky stain due to Leishman, Wright, Hastings, MacNeal and Giemsa. He considers that the latter fail to stain the cytoplasm of the malarial parasite with sufficient sharpness and intensity.

The author states that "it is evident that an ideal picture would result if the best of the methyl alcohol chromatin [Romanowsky] stains could be combined with Manson's cytoplasmic stain. After several attempts the following method was found to give the best results and it has been used for the routine of the laboratory [at Ancon, Panama Canal Zone] for thousands of blood preparations :—

"1. Fix and stain for two minutes in Wright's or similar methyl alcohol stain. It is most convenient and economical to use about 15 cc. of stain in a Coplin jar ; the top should fit well to prevent evaporation and the stain may be used repeatedly.

"2. Without washing, transfer the slide to a glass of tap water for from three to five minutes.

"3. Without washing, transfer to diluted Manson's stain for from twenty to forty seconds. One-half cc. (7 drops) of Manson's stain to 50 cc. of tap water in a Coplin jar gives about the proper strength. This staining fluid in concentrated form keeps well, but the diluted stain should be freshly prepared each day.

"4. Wash quickly in tap water, dry and examine."

Manson's stain "is made by dissolving 5 gm. of borax in 100 cc. of boiling water and adding 2 gm. of methylene blue, medicinally pure ; when cool the volume is made up to 100 cc. and the stain is ready for use."

[Apparently the author is unaware that some ten years ago Billet devised a similar stain for the same purpose, namely, the intensification

of the staining of the cytoplasm. It consisted in adding sodium carbonate to methylene blue, and the addition of a few drops of this mixture to the azure II and eosin of Giemsa. See *C. R. Soc. Biol.* (1906), vol. 61, p. 753. The reviewer has used Billet's stain and finds that it gives excellent results, even with such difficult subjects as the Spirochaetes of molluscs.]

H. B. F.

Carini (A.). **Corps de Graham-Smith dans les Hématies du *Mus decumanus*.—*Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 103–104.**

The bodies of Graham-Smith, first seen in the red blood corpuscles of moles in 1905, were found by the author in the blood of a large *Mus decumanus* killed at São Paulo, Brazil. The rat was quite healthy. The parasitised corpuscles showed no alteration, but polychromatophile red cells and others containing Anaplasma-like granules were also present. The Graham-Smith bodies were more numerous in the blood from the internal organs.

The bodies were coccoid or bacilliform, and measured 1μ by $0{\cdot}2\mu$ to $0{\cdot}3\mu$. The number in a corpuscle varied from six to twenty. They were coloured blue by Giemsa or Pappenheim stains.

This is the first record of these structures in America, and if organismal the name *Grahamella muris* is proposed.

H. B. F.

Carini (A.) & Maciel (J.). **Sobre o *Pneumocystis carinii*.—*Annaes Paulistas de Medicina e Cirurgia*. 1914. June. Vol. 2. No. 6. pp. 170–173. With 1 coloured plate.**

The authors state that the parasite, *Pneumocystis carinii*, occurs in the lungs of non-trypanosome-infected animals. Among the animals which have already been found infected are rats, guinea-pigs, rabbits, dogs, cats, lambs and goats. The parasite was first described by Delanoë [see this *Bulletin*, Vol. I, p. 58, and Vol. 3, p. 523]. It has only been found in the lungs, and its pathogenicity is slight. It occurs in round or slightly oval capsules, about 5μ in diameter, containing eight merozoites often arranged in a rosette. No blepharoplast was observed. Some cysts contain larger merozoites regularly arranged, others contain smaller merozoites somewhat irregularly disposed and pale staining. The pneumocysts are usually free and only occasionally intracellular. Delanoë thinks that the parasite is transmitted by contact, and Carini and Maciel suggest that this may occur in coughing. Feeding experiments were not conclusive. Pneumocysts have no relation to the life-cycle of trypanosomes, and the authors state that Chagas and Aragão now accept this view.

The paper is illustrated by a coloured plate of 26 figures representing the morphology of the organism.

H. B. F.

Carini (A.) & Maciel (J.). **Sur un hémogrégarine et un trypanosome d'un Muridé** (*Akodon fuliginosus*).—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 165–169. With 2 text figs.

One of the authors having visited Apiahy, in the south-east of São Paulo, Brazil, to investigate the cause of death of numerous rats there, found that they had died of starvation due to the lack of their usual vegetable food. Some of the same rodents, *Akodon fuliginosus*, were caught and were found to contain a (Leuco) Haemogregarine and a trypanosome in their blood. Both organisms are considered to be new species.

(*Leuco*) *Haemogregarina akodoni* is reniform in shape, its dimensions being 10 μ by 3·5 μ. It occurs in large mononuclear cells, whose nuclei tend to fragment. The nucleus of the free vermicule measures 4 μ by 2·5 μ. The parasites observed were all at the same stage of development. They were most abundant in lung smears and occurred in fewer numbers in the liver, bone-marrow and kidney. No schizogonic stages were seen. The organisms were present in 4 out of 12 rats examined, and the latter seemed unaffected by the parasite.

Trypanosoma akodoni occurred in the blood of the rats that harboured the haemogregarines. They were not numerous. Their total length including the flagellum was 19 μ to 22 μ, the free flagellum being 5 μ. The breadth was 2 μ to 2·5 μ. Morphologically, the trypanosome resembled *T. cruzi*, as it possessed a rather large blepharoplast, and so differed from *T. lewisi*. Attempts to inoculate laboratory animals and to infect larvae of the bug, *Triatoma infestans*, were unsuccessful.

H. B. F.

Sangiorgi (Giuseppe). **Sulla Natura dei Cosidetti "Corpi di Kurloff"** [On the Nature of the so-called Kurloff Bodies.]—*Pathologica.* 1915. June 1. Vol. 7. No. 158. pp. 263–266.

The first part of the paper deals with the chief hypotheses that have been advanced as to the nature of the so-called Kurloff bodies. These hypotheses on the one hand formulate that the structures are organismal, on the other that they are inanimate. Six of these hypotheses are summarised, namely, those in which the bodies are considered to be either vacuolar secretory products of the mononuclear leucocytes of guinea-pigs, protozoa (either flagellates, Leucocytozoa or Cytoryctes), phagocytic products, Chlamydozoa, archoplasmic products, or spirochaetes.

The author found Kurloff bodies in the lungs and spleen of guinea-pigs. To test the possible transmissibility of the bodies he inoculated white rats intraperitoneally, subcutaneously and intramuscularly with heavily infected lung and spleen emulsion obtained from guinea-pigs. He also fed rats with similar material. The results were always negative. To determine whether the bodies had a definite structure, the author examined fixed and stained material, both smears and sections. No satisfactory cellular structures were seen in the Kurloff bodies. Sections of the lung, and sometimes of the spleen, were stained

with Sudan III. It is concluded that there is a lipoid perivacuolar zone, together with endovacuolar sudanophile granulations. The granules are considered to be in part of a lipoid nature.

In his conclusions the author states that the so-called Kurloff bodies are neither parasitic nor protozoal in nature. They cannot be transmitted experimentally, and they do not show structures corresponding to any protozoön. He agrees with various workers that the bodies are not organismal, but are vacuolar formations in the mononuclear leucocytes of guinea-pigs, containing an autogenous fluid secretion. The results of his researches show that the endovacuolar secretion has in part a lipoid nature.

H. B. F.

ERRATUM.

Vol. 5. No. 6. p. 388, ten lines from bottom—*for* dissolved in 10 per cent. acetone *read* in ten per cent. solution in acetone.

RELAPSING FEVER.

Drake-Brockman (R. E.). **On an Epidemic of African Tick Fever among the Troops in British Somaliland.**—*Trans. Soc. Trop. Med. & Hyg.* 1915. June. Vol. 8. No. 7. pp. 201–207.

This consists of a more complete description of an epidemic of African relapsing fever at Bulhar, British Somaliland [see this *Bulletin*, Vol. 5, p. 231], which is apparently transmitted by *Ornithodorus savignyi*, a tick which bites both by day and night. The author adds some interesting notes on the biology of this tick and describes the disease in some detail.

In the course of the discussion following this paper Dr. C. J. Baker mentioned that in 1910 some troops went from Uganda to Somaliland and possibly took a spirochaete with them, which may have lain dormant or unrecognised until 1912.

E. Hindle.

Macfie (J. W. Scott). **Bronchial Spirochaetosis.**—*Jl. Trop. Med. & Hyg.* 1915. Mar. 15. Vol. 18. No. 6. pp. 63–65.

The author describes two cases of bronchial spirochaetosis that have recently come under his notice at Accra in the Gold Coast Colony. After mentioning the clinical symptoms of these patients, he goes on to describe the morphology of the spirochaetes occurring in the sputum.

In both cases the parasites presented the same appearance and were of about the same magnitude. They stained well, but faintly, with Romanowsky, but gentian violet was better for bringing out details. The average length is 8 to 9μ and there are three to four spirals; the breadth is about 0·25μ. The spirochaetes taper at both ends and in general appearance resemble those figured by Chalmers and O'Farrell from the Sudan, but are distinctly shorter.

Spirochaetes indistinguishable from these were found to occur normally in the mouths of healthy natives, and it is suggested that in the two patients mentioned by the author the disease of the bronchi and lungs may have been due to an invasion of these organs by these parasites as the result of some predisposing factor that is at present obscure.

E. H.

Fantham (H. B.). *Spirochaeta bronchialis*, **Castellani, 1907, together with Remarks on the Spirochaetes of the Human Mouth. (Being the First Report of the Thirty-first Expedition of the Liverpool School of Tropical Medicine, to Khartoum, 1913).**—*Ann. Trop. Med. & Parasit.* 1915. July 31. Vol. 9. No. 3. pp. 391–412. With 1 plate.

Spirochaeta bronchialis and the disease which it is supposed to produce in man have recently been the subject of various publications, in which, however, more attention has been paid to the disease itself than the causative agent. In the present publication the author describes in detail the parasite itself, and in addition adds notes on

the spirochaetes of the human mouth and contrasts these organisms with *S. bronchialis*. The author's summary and conclusions embodying the contents of his paper are as follows :—

"1. *Spirochaeta bronchialis* is an organism presenting marked polymorphism, a feature that has only been determined by the examination of numerous preparations from various patients. It produces bronchial affections in the Sudan and in other parts of the world.

"2. *S. bronchialis*, as investigated in the Anglo-Egyptian Sudan, varies in length from 5μ to 27μ, and its breadth is about 0·2μ to 0·6μ. These variations are due to the processes of growth and division. Many of the parasites measure either 14μ to 16μ long, or 7μ to 9μ, the latter resulting from transverse division of the former. The ends show much variation in form, but approach the acuminate type on the whole. The discrepancies in dimensions given by the very few previous workers on *S. bronchialis* are the result of the measurement of a limited number of parasites. All such sizes can be found on some occasion during the progress of the disease, when a larger number of spirochaetes is examined.

"3. The movements of *S. bronchialis* are active, but of relatively short duration, when it is removed from the body. The number of coils of the spirochaetes is rather an index of its rapidity of motion than a fixed characteristic of the species.

"4. The motile phase of *S. bronchialis* is succeeded by one of granule formation, the granules or coccoid bodies serving as a resting stage from which new spirochaetes are produced. The formation of coccoid bodies and the reproduction of spirochaetes from them can be observed in life.

"5. *S. bronchialis* is a species distinct from the spirochaetes occurring in the mouth. It differs from them in morphology, pathogenicity and in staining reactions. It is not a developmental form of any bacterium, and is an entity in itself.

"6. The passage from man to man is effected most probably by means of spirochaetes, and especially coccoid bodies, that leave the body in the spray with expired air and by the way of the nasal secretions. Owing to the fragility and short life of *S. bronchialis* extracorporeally, the resistant coccoid bodies in air, dried sputum and dust, and possibly also on the bodies of flies and other insects, are probably instrumental in inducing attacks of bronchial spirochaetosis in human beings, especially those having a lowered bodily resistance, such as after a chill.

"7. Spirochaetes of the type of *S. dentium*, measuring 4μ to 10μ in length, have been found in mouths of natives of the Sudan and in those of English people in England. Also *S. buccalis*, measuring 9μ to 22μ, has been obtained from the same sources.

"8. *S. bronchialis* will probably prove to be of more frequent occurrence than is known at present.

E. H.

Walko (Karl). **Ueber das Rückfallfieber.** [Relapsing Fever.]—*Wien. Klin. Woch.* 1915. May 13. Vol. 28. No. 19. pp. 491–494.

The author brings together his notes on 190 cases of European relapsing fever (*S. recurrentis*) occurring amongst soldiers from Serbia.

He remarks that although relapsing fever is very characteristic in its clinical symptoms, it is necessary to take into consideration a number of characters in order to distinguish it, as different epidemics may be of varying types.

The article consists mainly of a detailed account of the clinical symptoms, in the course of which a case is mentioned of reinfection occurring only eleven weeks after the first infection, so it is evident that the immunity is of very short duration. The mortality in these 190 patients was only 2·6 per cent., but in certain cases recovery was extremely slow, convalescence lasting for two or three months.

The following cases of mixed infection were observed :—With cholera, 25 cases ; with typhoid, 14 ; with typhus, 5 ; with dysentery, 3 ; and with epidemic meningitis, 1 case.

Salvarsan and neosalvarsan were used with success for the treatment of the infection. In some cases the neosalvarsan was injected during the interval between two attacks and in only two cases were there any further relapses, thus showing that the persistent stage of the spirochaete is not resistant to arsenic. When the patients received 0·6 gm. of neosalvarsan administered intravenously relapses were only observed in 5 per cent. of the cases, but after smaller doses, especially when given intramuscularly, a larger number of relapses occurred. In all cases, however, these relapses were very mild in character, only consisting of a slight rise in temperature.

E. H.

Jarno (Leo). **Die Mitbeteiligung der Nieren bei Rückfallfieber.** [The Part played by the Kidney in Cases of Relapsing Fever.]—*Wien. Klin. Woch.* 1915. Apr. 22. Vol. 28. No. 16. pp. 416–417. With 1 chart.

The author has examined the urine of patients suffering from relapsing fever and finds that during each febrile attack albumin and granular casts appear in the urine. A curve is given showing the percentage of albumin in the urine during the successive attacks of a case of relapsing fever and from this it appears that during each febrile period there is about 0·5 per cent. to 1·5 per cent. of albumin present in the urine.

This albuminuria is no contra-indication against the use of salvarsan or neosalvarsan.

In only two out of 170 cases was haemorrhagic nephritis observed and although searched for repeatedly, spirochaetes were only once found in the urine.

E. H.

Papendieck (Rudolf Max). **Neosalvarsanbehandlung bei Rückfallfieber.** [The Treatment of Relapsing Fever with Neosalvarsan.]—*München. Med. Woch.* 1915. Apr. 20. Vol. 62. No. 16. p. 545. With 1 chart.

The record of a case of European relapsing fever in a Russian which was cured by two injections of neosalvarsan. The first injection (0·6 gm.) was administered when spirochaetes were numerous in the blood and caused the temperature to fall within half an hour. A second injection of 0·3 gm. was administered ten days later as spirochaetes were still present in the circulation and the fever had returned. After this injection the parasites disappeared and the temperature returned to the normal.

E. H.

Muehlens, Hegeler & Canaan. **Misserfolge der Arrhenalbehandlung bei Rückfallfieber.** [The Failure of Arrhenal Treatment for Relapsing Fever.] *München. Med. Woch.* 1915. May 25. Vol. 62. No. 21. pp. 710–711.

In an article published in 1912 Schneider* stated that relapsing fever could be cured by doses of 0·05 gm. arrhenal. The authors attempted to treat some cases of Russian relapsing fever with this medicament and found that it did not affect the course of the disease, even though administered intravenously in doses of 0·2 gm. per day. Arrhenal, therefore, is apparently of no use in the treatment of this disease.

E. H.

Aoki (K.). **Studium über die Atoxylwirkung und die Immunität bei Hühnerspirochäten.** [Studies on the Action of Atoxyl and Immunity in Fowl Spirochaetosis.]—*Zeitschr. f. Immunitätsforsch.* 1. Teil. Orig. 1914. Nov. 7. Vol. 23. No. 2. pp. 127–203. With 6 text figs.

In this exhaustive article the author gives extensive references to the literature on the subject and derives his conclusions both from the results of numerous original experiments and also those of previous investigators. In the present place it is impossible to give more than the main conclusions, and for further details the original paper should be consulted.

With regard to agglutinins, these are formed within a short time of the injection of atoxyl into a fowl suffering from spirochaetosis and their formation goes parallel with the disappearance of the parasites. At the same time agglutinin formation goes up very suddenly during the natural crisis of a recovered individual. By the action of atoxyl apparently, a protective condition is produced against the infection before the spirochaetes quite disappear from the circulation. This condition is of a specific nature and is transmitted passively through the serum of normal animals. Moreover it has the properties of a true immunity and does not seem to follow the death of the spirochaetes, but rather to be the cause of their destruction.

Atoxyl acts better as a curative than a protective agent. Animals which were injected at the same time with atoxyl and spirochaetes were protected against the infection only if they gave a strong reaction and quickly showed signs of sickness.

For example fowls were injected with a larger quantity of blood containing spirochaetes and at the same time with a curative dose of atoxyl. Those animals which soon showed signs of sickness were all protected against subsequent attempts to infect them with spirochaetosis. On the other hand those fowls which were quite lively after the injection later developed the infection and succumbed.

The author suggests that the affinity between the body-cells and the medicament in some way is increased by the connection between the body-cells and parasite so that eventually three factors, *viz.* body-cells, parasites and medicament react together quite freely within the body of the host.

* *Archiv. f. Schiffs- u. Tropen-Hygiene*, 1912. Vol. 16, pp. 150–162.

Atoxyl is so influenced by normal blood or blood-cells that *in vitro* trypanosomes are destroyed by a mixture of blood and atoxyl whilst this is not the case with spirochaetes. These results are the same whether the atoxyl is mixed with normal or infected blood. It is evident from the results of various authors that the action of atoxyl is increased after injection into the blood.

The above mentioned trypanosomes were not affected by the serum of an infected fowl that had been injected with a curative dose of atoxyl. On the other hand spirochaetes were destroyed by such serum taken from a fowl after the parasites had disappeared from its blood.

If infected fowls are injected with a very large dose of atoxyl so that they are strongly poisoned, the parasites are not destroyed, as the toxic effects of the drug apparently interfered with the reaction of the organism necessary for the destruction of the spirochaetes.

In a mixture of blood and atoxyl in which the trypanocidal effect was strongest, agglutination of the blood-cells was most distinct and also auto-haemolysis was most evident.

In the second part of the paper the author discusses various serum reactions of the parasite :—

(*a*) *Precipitin reaction.*—Employing spirochaete extract a feeble reaction can be obtained against immune serum, but a reaction is sometimes produced against normal serum, so it is useless to apply this method for diagnostic purposes.

These precipitin reactions vary with the severity of the infection. When it is fatal the reaction against spirochaete extract is more feeble, however distinct may be the reaction between this and immune serum. The reaction is checked after treatment with atoxyl.

(*b*) *Agglutination reaction.*—As in the case of ordinary bacteria this reaction is both easy and convenient to recognise *in vitro*, employing the serum of immunised animals. The serum of infected fowls, whether spirochaetes are present in the circulation or not, produces strong agglutination. If the spirochaetes are washed, or kept in the ice-chamber for a long time their agglutinating properties are lost, but although the reaction is slow, good agglutination can be obtained with heated spirochaetes.

When the parasites disappear after the crisis, the agglutinating properties of the serum rise very suddenly. The agglomeration of the spirochaetes that can be observed at the height of the infection is proof of the presence of agglutinins in the serum.

(*c*) *Fixation of the complement.*—This reaction could be detected either with spirochaete extract or the tissues of highly immunised animals.

(*d*) *Anaphylaxis.*—Fowls can be made anaphylactic with fowl spirochaetes, but the reaction is not so distinct as that produced by treating guinea-pigs with bacteria. With large quantities of spirochaetes it is possible to demonstrate the presence of anaphylotoxin without the aid of immune serum.

Guinea-pigs can be actively sensibilized by spirochaetes.

(*e*) *The influence of physical and chemical changes on the properties of the antigen.*—Fowls can be immunised against spirochaetosis by the

injection of infected serum freed from spirochaetes by heating, washing with chloroform and drying at 55° C for 24 hours. Although the antigen is not lost after this treatment, the addition of iodine at once destroys all its properties.

(*f*) *Spirochaetolysis.*—When mixed with immune serum spirochaetes show the same changes as occur in bacteriolysis, *viz.* immobilisation, agglutination, swelling, loss of staining properties, loss of form, breaking into fragments. Guinea-pig serum is not so suitable for complement as fowl serum.

(*g*) *Phagocytosis.*—This appearance and likewise the presence of immune bodies can be demonstrated *in vitro*. According to the author's observations there is also a second phenomenon accompanying it, as the spirochaetes were deformed quite independently of the leucocytes.

E. H.

WOLBACH (S. Burt). **On the Filterability and Biology of Spirochaetes.** —*Amer. Jl. Trop. Dis. & Prevent. Med.* 1915. Feb. Vol. 2. No. 8. pp. 494–505. With 2 plates.

The author discusses the filterability, morphology and distribution of *Spirochaeta duttoni* and the filterability, morphology and biology in cultur s of *Spirochaeta elusa*, and a new filterable spiral organism from human faeces.

With regard to *Spirochaeta duttoni* in ticks, the author has examined stained sections of a series of ticks fed on animals containing spirochaetes in their circulation. His results support those of MARCHOUX and COUVY and are opposed to the view that the granules found in epithelial cells come from spirochaetes.

The parasites were found to pass unchanged to all parts of the tick's body and although so-called encysted and coiled forms were observed they are not regarded as having anything to do with multiplication.

Spirochaeta elusa, an organism which grows well in dilute hay infusions of neutral or slightly acid reaction, showed the presence of granules, and lateral projections and swellings. Attempts to prove that coiled, encysted and swollen forms are capable of reproduction failed. This spirochaete passes through the Berkefeld N and W filters and repeated filtration has greatly enhanced its motility and filterability, so that whereas in the earlier generations the proportion of successful to unsuccessful filtrations was as 12 to 2, after about 75 passages through the filters there was practically 100 per cent. of successful filtrations. Spirochaetes were observed in the filtrate and also actually passing through the pores of the filter.

Spirochaeta biflexa resisted every attempt at subculture although over a hundred different conditions were provided, all based upon the character of the filtrate in which the growth occurred. The spirochaete from human faeces was cultivated at 37° C. in meat infusion bouillon in which it produces a white tenacious slime. Pure cultures were filterable through Berkefeld filters in one and a half to three hours by gravity.

The author's conclusions are as follows :—

"1. That the method of filtration as a means of separating spiral organisms from ordinary bacteria will probably hold good for other saprophytic and pathogenic spirochaetes and allied micro-organisms.

"2. That organisms larger than many bacteria will pass the Berkefeld V, N, and W filters, namely, *Spirochaeta duttoni*, and the ones we have tentatively called *Spirochaeta elusa*, *Spirochaeta biflexa* and the spiral organism from the colon of man which is probably the organism commonly recognized in preparations as an 'intestinal spirochaete.'

"3. That there is no evidence of spirochaetes multiplying by any other method than single fission. It is certain that the granules, coiled forms and swollen terminals of the spiral organisms cultivated by us are not capable of multiplication in any form."

E. H.

Bronfenbrenner (J.). **A New Principle in Isolation of Spirochetes in Pure Culture.**—*Proc. Soc. Experim. Biol. & Med.* 1915. Mar. 17. Vol. 12. No. 6. pp. 136–137.

Owing to bacterial contamination the author had great difficulty in attempting to isolate certain strains of spirochaetes, and numerous attempts at purification, using Noguchi's original method, failed for months. Having noticed that certain antiseptics in proper quantities exerted a marked accelerating action on the growth of spirochaetes, media were prepared containing salvarsan in very small amounts and finally after ten passages strains of spirochaetes were obtained which have remained pure for the last five months.

In another series of experiments the author tried to make use of the fact that aniline dyes, which exert marked sterilizing action on bacteria even in dilutions of 1 : 5,000 and 1 : 10,000, seem not to inhibit the growth of certain spirochaetes in much greater concentrations. The experiments in this direction are not yet completed, as so far the author has been unable to find a dye which would uniformly inhibit the growth of all the bacteria occurring in contaminated syphilitic material, in a concentration that would allow the life of all the different strains of spirochaetes.

E. H.

Launoy (L.) & Lévy-Bruhl (M.). **Sur la résistance des poules à l'infection par le *Spirochaeta gallinarum* après thyroïdectomie ou splénectomie.**—*Ann. Inst. Pasteur.* 1915. May. Vol. 29. No. 5. pp. 213–220.

The authors' conclusions are as follows :—

(1) The previous removal of the thyroid glands or spleen in an adult fowl does not diminish resistance to spirochaetal infection neither the production of immunity.

(2) The course of the disease is not appreciably affected in fowls that have had their thyroids removed.

(3) In splenectomised fowls, the septicaemia was appreciably more intense than in controls ; on the contrary, the clinical aspect of the disease is much more benign and the symptoms of intoxication very slight.

E. H.

Fantham (H. B.). **A Note on the Methods of investigating the Biology of Spirochaetes.**—*Amer. Jl. Trop. Dis. & Prevent Med.* 1915. May. Vol. 2. No. 11. pp. 715–716.

An answer to an article by Wolbach [see above, p. 216,] in which certain statements made by Fantham in his paper on "The granule Phase of Spirochaetes" had been criticised.

E. H.

KALA AZAR.

MACKIE (F. Percival). **Insects and Kala Azar.**—*Indian Jl. Med. Res.* 1915. Apr. Vol. 2. No. 4. pp. 942–949.

The author records in this paper the results of a long series of experiments made by him with various arthropods and leeches in connection with the spread of kala azar.

Body lice, head lice, and bed bugs were taken from the bodies or bed coverings of cases of undoubted kala azar. Numbers of these were dissected for microscopic examination while the contents of others were injected into monkeys. The results were all negative. The number of these examinations was as follows :—

Body Lice.—Microscopic Examination	..	1,172
Animal Experiment ..	..	856
Head Lice.—Microscopic Examination	..	1,170
Animal Experiment ..	..	1,130
Bed Bugs. —Microscopic Examination	..	1,512
Animal Experiment ..	..	815

A number of bed bugs bred from the egg in the laboratory were fed on cases of kala azar. Of such 322 were dissected and examined microscopically. In only two did the author find recognizable leishmania, to the extent of two in each bug. The contents of 588 bugs were injected into two monkeys which did not become infected.

Similar experiments (284 dissections and 284 injections into a monkey) were made with mosquitoes which had recently fed taken from the mosquito nets of kala azar patients. The results here were again quite negative.

In the examination of 384 sand-flies (Phlebotomus) from the neighbourhood of kala azar cases it was found that a certain number harboured a herpetomonas [see this *Bulletin*, Vol. 5, p. 282], some a Bodo-like parasite and others a Sporozoon-like parasite which occurred in the form of capsulated hyaline oval bodies which were often partially encysted in groups.

Sixty-nine leeches were allowed to feed once on patients whose blood contained *Leishmania donovani*. They were dissected from one to two months after the feed but nothing was found.

The author remarks that this long series of negative results rather tends to check enthusiasm for the insect-borne hypothesis of kala azar, but in view of the many fallacies and difficulties which surround an investigation of this sort it cannot be looked upon as anything but an introduction to a subject which demands an infinite amount of further investigation.

C. M. Wenyon.

MACKIE (F. Percival). **The Experimental Transmission of Indian Kala-Azar to Animals.**—*Indian Jl. Med. Res.* 1915. Apr. Vol. 2. No. 4. pp. 934–941.

This paper contains the details of a large number of experiments conducted with a view to determining the susceptibility of various

animals to the virus of kala azar in Assam. The following are the author's conclusions :—

" 1. Monkeys (*Macacus rhesus*), flying foxes (*Pteropus edwardsii*), dogs and white mice were found to be susceptible to the virus of Indian kala-azar when inoculated by the intra-peritoneal route.

" 2. The production of the disease in these animals is very uncertain, for though some experiments were successful, a number of others were unsuccessful even when identical doses of the same material were administered to animals of the same species. This means that any attempt to prove the infectivity of suspected material by animal experiment is apt to be fallacious.

" 3. Feeding experiments using large quantities of freshly removed and highly infected spleen substance from human subjects, were uniformly negative.

" 4. It is noteworthy that young cats, goats and a young pig (animals commonly living in close intimacy with human beings in Assam villages) were able to resist enormous doses of very virulent material by intra-peritoneal inoculation. These animals, therefore, may be considered naturally immune.

" 5. The microscopical examination of the spleen and bone marrow of over one hundred dogs, selected from kala azar villages, has not revealed the presence of *Leishmania* in any of them.

The bone-marrow of twenty-five of these same dogs was inoculated into monkeys and bats without result.

" 6. The question of the possible infectivity of the faeces of kala azar patients received considerable attention for over a year. The intestinal mucus of many patients in various stages of the disease was administered orally to five monkeys and three dogs, but these animals did not develop kala azar.

" 7. The intestinal contents of 3,673 verminous insects caught on kala-azar patients were subcutaneously inoculated into eight monkeys, but none of these developed kala-azar.

" 8. Material obtained from cutaneous ulcers, occurring in kala-azar infected areas, has not proved to be infective to animals, nor were *Leishmania* discovered microscopically in such ulcers.

" 9. The experiments detailed in this paper do not support the belief that any of the animals referred to are natural " reservoirs " of the virus of kala azar in Assam villages. The most that can be said is that young dogs are more susceptible to experimental infection than any of the other animals which were used."

C. M. W.

Rogers (Leonard) & Shorten (A. J.). **The Alkalinity of the Blood in Kala-Azar and Cholera, and the Technique of its Estimation.**— *Indian Jl. Med. Res.* 1915. Apr. Vol. 2. No. 4. pp. 867–881. With 1 text-fig.

In this paper the technique employed by the writers for the determination of the alkalinity of the blood is described at some length and those intending to follow the method must consult the original description. The blood was tested in seventeen cases of kala azar, which are arranged in a table in accordance with the progress of the patient. It results that with the exception of complicated cases and those staying in hospital only a few days all the kala azar patients who got worse or showed no improvement presented a marked reduction in the alkalinity of the blood, which was greatest in those who progressively deteriorated in spite of every care in hospital.

It must also be noted that the disease progressed in spite of the fact that the alkalinity of the blood had been temporarily raised by treatment directed towards this end. In five cases which showed either

marked improvement or cure, as evidenced not only by general improvement in health but also by the failure to find parasites in the spleen after repeated punctures, the alkalinity was either high or only slightly reduced—a fact which clearly demonstrates the importance of the reduction of the alkalinity of the blood as a factor in the fatality of this dread disease. There does not seem to be any definite correlation between the degree of anaemia and the diminished alkalinity of the blood, though with the degree of leucopenia a more definite relation can be traced.

[On the subject of the alkalinity of the blood in kala azar it is of interest to recall the observations of Capt. R. G. Archibald, which the author fails to mention in his paper. This observer studied the subject under discussion in four cases of undoubted kala azar in the Sudan and noted that the alkalinity of the blood was diminished and suggested that a line of treatment should be adopted with a view to increasing this alkalinity. The results obtained by Rogers appears to agree with those of Archibald in the Sudan in 1910 (*Jl. R. Army Med. Corps*, 1910, Vol. 14, pp. 615–620).] C. M. W.

Giugni (Francesco) & Benoni (Francesco). **Sul comportamento *in vitro* delle Leishmanie col Melitense, coi Germi tifici, para-tifici, e coi loro sieri agglutinanti. La contemporanea infezione di febbre mediterranea e Leishm. int[a].** [The Behaviour *in vitro* of Leishmania with the Organisms of Undulant Fever, Typhoid and Paratyphoid and their Agglutinating Serums.]—*Malaria e Malat. d. Paesi Caldi.* 1915. Mar.-Apr. Vol. 6. No. 2. pp. 89–94.

The authors have investigated the effect of inoculating cultures of *Leishmania tropica, L. infantum, L. donovani* and *L. canis* of various origins with different bacteria. Those employed were Eberth's bacillus, bacillus paratyphoid A and paratyphoid B and the *Micrococcus melitensis*. The cultures of the leishmania quickly died off, if they had already developed, when inoculated with the bacteria or they did not develop if the tubes were inoculated with the bacteria and leishmania at the same time. The *Micrococcus melitensis* was, however, an exception, for with it the culture of leishmania developed for about a week before showing signs of degeneration.

Another series of experiments was conducted with a view to testing the influence of the various sera which agglutinated the bacteria used. It was found that the active sera did not differ in their action on the leishmania from ordinary inactive sera.

As a result of these experiments it is noted that the cultures of leishmania survive only with the *Micrococcus melitensis*, a laboratory result which agrees with the clinical finding that the two diseases, infantile kala azar and undulant fever, may be concomitant.

C. M. W.

Rogers (Leonard). **Further Work on the Treatment of Kala-Azar, with Special Reference to Leucocyte increasing Methods, Spleen Tabloids and Alkalies.**—*Indian Med. Gaz.* 1915. May. Vol. 50. No. 5. pp. 163–170. With 4 charts.

The paper contains an account of various methods of treatment of kala azar practised by the author during the past fifteen years. There

are three main facts which are regarded as of greatest importance in indicating the most promising lines of treatment in kala azar. Firstly, it is quite exceptional for the patient to die directly from the fever which is such a striking and obstinate feature of the disease; he succumbs generally to a secondary infection. Secondly, the prognosis is bad in direct proportion to the reduction in the polynuclear leucocytes in the blood; and thirdly, spontaneous, complete and permanent recovery occasionally follows such infections as cancrum oris and pneumonia provided they produce a considerable increase in the greatly reduced leucocytes. Arsenic as a remedy has very little permanent action though it is of some value for the anaemia. Iodine intravenously in solution in distilled water and potassium iodide and of the strength of tincture of iodine was injected in a dose of three minims, increasing to seven or eight, at two days' intervals. This produced no change either in the clinical features of the disease or its parasite. Sodium nucleate was injected subcutaneously with a view to increasing the leucocytes. The author says of this treatment that it must be classed with the many other failures he has experienced in his many years' search for a satisfactory treatment. In view of the remarkable recoveries sometimes following septic infection, the preparation Phylacogen made of mixed bacterial toxins was tried, but though the reaction was often severe it was a complete failure.

Turpentine injection with the object of increasing the leucocytes is extremely painful and was without favourable results. Dead staphylococcus vaccine had the property of increasing the leucocytes and bringing about some improvement in the condition of the patient, an improvement which unfortunately was too often of a temporary nature. The use of living sensitised staphylococcus vaccine was no improvement and was not without danger. The author now employs a staphylococcus vaccine which has been sensitised and killed either by heating to 60° C. or by adding half per cent. carbolic acid. Spleen substance tabloids have done no harm but failed to produce any improvement. Intravenous injections of sodium bicarbonate, with the object of testing if a sudden increase in the alkalinity of the blood would have any effect on the temperature, were tried. There was in two cases an immediate decline in the temperature which, however, began to rise again after eight and two days respectively. Steady administration of alkalies by the mouth was tried. The results are clearly better than those obtained by any other line of treatment dealt with in the paper. Most of the cases which were not in a very advanced stage when the treatment was undertaken did well and in some the improvement following the treatment was very remarkable. It cannot, however, be considered a specific treatment of the disease but has the advantage of being readily combined with the other beneficial measures, such as the subcutaneous injection of dead sensitised staphylococcus vaccine and the exhibition of spleen or bone marrow tabloids.

C. M. W.

Rogers (Leonard). **Tartar Emetic in Kala-Azar.** (Correspondence.) —*Brit. Med. Jl.* 1915. July 31. p. 197.

The writer of this letter has just seen the paper on the treatment of kala azar by Di Cristina and Caronia [see this *Bulletin*, Vol. 5, p. 269]

by means of intravenous injections of tartar emetic. He wishes it to be known that quite independently of these workers and even without knowledge that Gaspar Vianna had success with this mode of treatment in the cutaneous leishmaniasis of South America he himself had arranged to treat kala azar cases in this way so far back as October, 1914. It was only six months later he had an opportunity of doing this and he has now treated ten cases and has noted in several of them marked and rapid decline of temperature, together with some gain in weight, diminution in the size of the spleen, increase in the number of leucocytes and decrease in the number of parasites found on spleen puncture—all of which are most promising signs.

He concludes his letter by claiming to have originated the intravenous use of tartar emetic in kala azar quite independently of any other worker and to have obtained a considerable degree of success with it before any other results came to his knowledge. [A notice of Gaspar Vianna's treatment of American Cutaneous Leishmaniasis by means of tartar emetic appeared in this *Bulletin*, February 14th, 1914. It is to this observer that the credit of first employing the drug intravenously in leishmaniasis is due, and to Di Cristina and Caronia for using it in kala azar with success must be given the credit of priority, even though the possibility of employing the drug in kala azar had previously been in the minds of most people having any knowledge of the disease.]

C. M. W.

Castellani (Aldo). **Brief Note on the Treatment of a Case of Kala-Azar.**—*Jl. Trop. Med. & Hyg.* 1915. May 15. Vol. 18. No. 10. pp. 112–113; *Pediatria*. 1915. Apr. Vol. 23. No. 4. pp. 241–243.

The author commences his paper by saying that he has given (elsewhere) the results of the treatment of cases of yaws by using tartar emetic, sodium salicylate, sodium bicarbonate and potassium iodide and that it may be of interest to give here the results of the treatment of a case of kala azar by using a similar line of treatment. The patient, an Indian coolie, who was very weak, was diagnosed as a case of kala azar by spleen puncture, numerous leishmania being discovered. He had been in Ceylon three months but had probably contracted the disease in India. He was treated with the author's so-called yaws mixture by the mouth, by intravenous injections of solutions of tartar emetic and liq. Fowleri, and by intravenous injections of solutions of tartar emetic alone.

The yaws mixture contains tartar emetic gr. i, sodii salicyl. 5–10 gr., pot. iod. 1 dr., sodii bicarb. 15 gr. to 1 oz. water. The mixture is pharmacologically very inelegant owing to the bicarbonate of soda but this decreases the emetic properties of the mixture. In yaws patients three doses (1 oz. each) are given daily diluted in four times as much water for adults; half doses to children aged 8–14 years and one-third doses to younger children. The treatment is continued for ten to twenty days. The kala azar patient had three doses daily on alternate weeks for about two months but the pot. iod. had to be reduced to 15 grains per dose.

The solution of tartar emetic and liq. Fowleri was made up of tartar emetic 30 gr., liq. Fowleri 100 minims, aq. dist. 100 cc. One

or two cc. diluted to 4 or 5 cc. with distilled water was injected intravenously twice a week for nearly three months. The tartar emetic alone was used in a 2 per cent. solution, the dose given being 2–10 cg. The patient was treated with these injections during the last two months but as he came irregularly he received one only about every 10th day.

A second spleen puncture was performed four months after treatment was started. Leishmania were still present but "apparently in distinctly smaller numbers."

The patient, who was treated as an out-patient after the first few weeks, finally ceased to attend as he considered himself cured.

C. M. W.

Sarkar (Sarasi Lal). **The Action of Quinine and Arsenical Preparations in Kala-Azar.**—*Indian Med. Gaz.* 1915. Mar. Vol. 50. No. 3. pp. 92–94.

The author quotes certain experiments conducted with a view to testing the effect of prolonged immersion of *Paramecium caudatum* in dilute quinine solutions. It was found that this protozoon was killed in about 20 minutes by a solution of quinine 1 in 25,000. If, however, the protozoa had previously been kept for 24–48 hours in a 1 in 100,000 solution they were killed much more quickly by the stronger solution. That is to say the dilute solution had considerably reduced their resisting powers.

The author believes the beneficial action of quinine injections in kala azar is due to the exposure of the parasites continually to very minute quantities of quinine absorbed from the site of inoculation.

The action of such drugs as atoxyl on trypanosomes in the body is due to a reduction product of atoxyl rather than to the atoxyl itself. Sometimes the atoxyl injected proves very toxic to the host and this is probably to be explained by the production very rapidly of a large quantity of this product of reduction. A case of kala azar treated by the author illustrates this point. The patient received $\frac{1}{2}$ grain injections of soamin on alternate days. After three or four of these he showed symptoms of arsenical poisoning which was treated by the author by injections of staphylococcus vaccine by way of experiment. The patient recovered from the poisoning and has now remained well for two years. The author supposes that an extra quantity of reduction bodies was produced in this case and that it tended to poison the patient but actually killed the parasites of kala azar.

C. M. W.

Lafont (A.) & Heckenroth (F.). **Un Cas de leishmaniose canine à Dakar.**—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 5. No. 4. pp. 162–164.

At Dakar on the coast of Senegal (lat. 15°) the authors have examined upwards of a hundred dogs for evidence of leishmania infection. Finally they were successful in finding at the end of 1914 a dog suffering from generalized leishmaniasis. The dog was found in the streets of Dakar in an extreme condition of emaciation, mangy and covered with lice and ticks. It died later in the fourriere. At the autopsy the liver

and the spleen were both enlarged and showed on microscopic examination numerous leishmania. The dog's origin could not be traced but there appeared to be no possibility of its having been imported. It was certainly of the native breed with some trace of European blood. The disease, which is presumably the canine kala azar occurring in the districts along the Mediterranean littoral, must have been contracted locally and this is the first instance of its occurrence in West Africa. The presence of the disease in dogs suggests the possibility of the human or infantile malady occurring there also.

C. M. W.

GIUGNI (Francesco). **Alcuni tentativi di trasmissione della leishmaniosi canina. Andamento clinico e dati necroscopici di un caso di Leishmaniosi nel cane.** [Some Attempts to transmit Canine Leishmaniasis, Clinical Course and Necropsy Finding of a Case.]—*Malaria e Malat. d. Paesi Caldi.* 1915. Mar.-Apr. Vol. 6. No. 2. pp. 77–81.

A dog, which was heavily infected with leishmania and in the peripheral blood of which leishmania could constantly be found, was made to live in contact with two puppies from April 4th to June 12th when it died. It was covered with fleas and in order to ensure the passage of fleas from the infected dog to the puppies on four occasions 100 fleas were caught off the dog and transferred to the puppies. The puppies were killed on July 14th. They appeared perfectly healthy and an exhaustive examination of their organs by microscopic examination and by culture failed to reveal any parasites.

The author followed the clinical course of the disease in the infected dog in some detail. There was emaciation, partial loss of hair, and some weakness. The only change noted in the blood was a slight leucocytosis. The temperature taken in the rectum three times a day showed a continued remittent type of fever with very irregular elevations. There was a slight trace of albumin in the urine. Post-mortem the only change noted in the organs was an enlargement of the liver and spleen. An interesting point was that the worm *Spiroptera sanguinolenta* was found encysted in the oesophagus and in the contents of the worm some definite leishmania were discovered.

C. M. W.

SPAGNOLIO (Giuseppe). **Leishmaniosi canina ed umana e loro presunta dipendenza genetica.**—*Malaria e Malat. d. Paesi Caldi.* 1915. May-June. Vol. 6. No. 3. pp. 156–157.

In this note the author draws attention to the fact that in Messina at the present time, owing to the policy of destroying evidently infected dogs, canine kala azar appears to be very much reduced if not entirely absent. In 1910 BASILE reported that as many as 70 per cent. of the dogs were infected. It would be expected, according to the view that canine and infantile kala azar are intimately related to one another, that there would be a similar reduction in the incidence of the disease amongst children. This, however, has not been the case for each year there have been two or three cases. The author considers that this shows that the human and canine diseases are in no way related to one another.

Tropical Sore.

Yakimoff (W. L.) & Schockov (N. F.). **Leishmaniose cutanée (bouton d'Orient), au Turkestan russe.**—*C. R. Soc. Biol.* 1915. Mar. 19. Vol. 78. No. 5. pp. 107–109.

The mission which was sent to Russian Turkestan to study the human and animal diseases have found that oriental sore is widely distributed. The chief centres of observation have been Boukhara, Samarkand, Askabad and Termèze, the latter on the Russo-Afghanistan frontier. Two types of sore which have been considered by some to be two distinct diseases are in reality one and the same : in both, *Leishmania tropica* has been found. In Turkestan only 58·2 per cent. of the cases which are generally classed as this disease are in reality such ; this shows clearly the need of microscopic examination for diagnosis. At Termèze of 59 officers 40 contracted the disease and of these 32 were infected in Termèze itself, 4 at Askabad, 3 at Samarkand and 1 in the Caspian district. Of the 32 infected at Termèze 14 were attacked during the first year of sojourn there, 11 during the second year, 2 during the third, 1 during the fourth and 3 and 1 during the fifth and seventh years respectively. Among 36 soldiers who had the disease in Termèze as many as 29 were infected during the first year of residence.

As regards the time of year at which infection occurs, amongst 48 cases seen in January in 1 the disease had appeared in June, in 7 in July, in 40 in August. Of 28 officers 10 per cent. had the disease appear in June and 45 per cent. in August.

The single sore is most commonly seen but as many as 17 may occur. The duration of the disease is from two months to a year or even two years and a half. As a rule it varies from four to six months. Of 46 cases 38 had the disease only once and 8 twice.

Leishmania were never found in the peripheral blood. A lymphocyte increase up to 43 per cent. with a decrease in polynuclears to 46 per cent. was noted. The eosinophiles were frequently 6 per cent.

Work with mosquitos and bed bugs gave only negative results.

It is pointed out that in Turkestan there exist two forms of *Leishmania tropica.* These are :—

1. Large parasites mostly spherical but rarely elongated. The cytoplasm is very liquid, often vacuolated, and colouring a pale blue ; the nucleus stains faintly red ; it is not compact and consists of isolated granules ; it is usually round or oval. The blepharoplast, in the form of a rod, arc or dot, colours deeply ; its position in reference to the nucleus varies. The maximum dimensions of these large parasites are 5·42 by 3·92μ ; the nucleus 2·74μ in diameter and the blepharoplast not less than 0·39μ.

2. Small parasites having generally the form of a grain of rice but being sometimes round or oval. The cytoplasm is dense and stains a deep blue ; sometimes one can note in it small black grains not unlike malarial pigment. The nucleus, round or oval and compact, stains deeply while the blepharoplast is practically always rod-like. The small parasites attain as a maximum 3·92 by 3·15μ. The small form which the authors name *Leishmania tropica* var. *min.* is the predominant form at Boukhara, Askabad and Samarkand, the larger form *Leishmania tropica* var. *maj.* at Termèze.

Pus from a sore on the ear of a patient was inoculated into a mouse intraperitoneally. The animal contracted a general leishmania infection.

The treatment adopted in Turkestan is to powder with medicinal methylene blue. By this method good results are obtained, for some of the sores heal at the end of one and a half or two weeks.

A dog was encountered with a sore on the neck and another on the back. Large leishmania 8μ in diameter and called *L. tropica* var. *canina* were found in them.

C. M. W.

LAVERAN (A.). **Des Lacertiens peuvent-ils être infectés par des Leishmania?**—*Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 104–109.

The possibility of lizards taking part in the spread of oriental sore is discussed in this interesting note. SERGENT (Ed. and Et.), LEMAIRE and SÉNEVET showed that cultures of a flagellate closely resembling the cultures of leishmania could be obtained by inoculating N.N.N. medium from the organs of the Algerian gecko *Tarentola mauritanica* in 15·7 per cent. of cases. In 14·4 per cent. of cases a culture of a trypanosome (probably *T. platydactyli*) showing crithidial forms was also obtained but these flagellates could easily be distinguished from those of the leishmania type. It was suggested by the authors that the gecko in question might be a reservoir for the virus of oriental sore, especially as the *Phlebotomus minutus africanus* at Biskra fed both on man and the gecko.

HOWLETT in India has shown that the Indian *P. minutus* also feeds on lizards while ROUBAUD has shown the same to be true of other parts of Africa.

CHATTON and BLANC found in the blood of eight geckos from Metlaoui in Tunis small spindle bodies grouped in vacuoles at one end of the red cells; they bear some resemblance to toxoplasma but have in addition to a median nucleus a centrosome or blepharoplast as in leishmania [see this *Bulletin*, Vol. 5, p. 289.]. It is a question whether the cultures obtained from the organs of geckos mentioned above have their origin in the intra-corpuscular bodies of CHATTON and BLANC.

A further point of interest in this connection is the observation of LINDSAY in Paraguay that the travellers who contract cutaneous leishmaniasis in the forest districts attribute their infection to the bites of Ixodidae (*Amblyoma striatum*) and Simulidae (called locally "mbariquies") which have previously fed upon the hissing snakes which have a special attraction for them.

With a view to the elucidation of this problem of a reptilian host for the leishmania the author has made attempts to infect lizards. Two geckos (*Tarentola mauritanica*) were inoculated twice subcutaneously—once with a testicular extract from a mouse very rich in *L. tropica* and once with a culture of the same organism. Another gecko was inoculated on two occasions intraperitoneally with rich cultures of the same parasites. The result was absolutely negative. A further attempt was made to infect four specimens of *Lacerta viridis*, also without success. One *Lacerta viridis* was inoculated intraperitoneally with an extract of the spleen of a dog heavily infected with

Leishmania infantum. After 30 days puncture of the peritoneum gave some cells containing leishmania. From the peritoneal fluid, however, no culture could be obtained. Two other lizards gave a completely negative result.

The author points out that though these experiments are somewhat meagre and have need of extension still they lend no support to the view of there being a lizard reservoir for *L. tropica.* In collaboration with Franchini he has shown that certain flagellates of fleas and mosquitos may produce mild infections when injected into animals and it is conceivable that in certain localities, such as the oases of the Sahara, the high temperature or other conditions might lead to an increase in virulence of what are usually harmless insect parasites. The frequency with which Simulidae and Phlebotomus occur in the oriental sore areas has suggested that these flies may be the vectors of the *Leishmania tropica.* In 1909 Georgevitch* described a Crithidia from the simulium of Servia while Wenyon† in 1912 recorded a herpetomonas in the Phlebotomus of Aleppo, Syria, and later Mackie one from the *Phlebotomus minutus* in India [see this *Bulletin*, Vol. 5, p. 282.] Wenyon and Mackie both assumed that these were harmless flagellates of the insects in question but the author points out that they may in reality have some connection with the spread of oriental sore. There is scope for further investigations along these lines.

C. M. W.

Sergent (Edm.), Sergent (Et.), Lemaire (G.) & Sénevet (G.). **Hypothèse sur le phlébotome "transmetteur" et la tarente "reservoir de virus" du bouton d'Orient.**—*Ann. Inst. Past.* 1915. July. Vol. 29. No. 7. pp. 309–322.

This paper is a discussion on the possibility of a species of Phlebotomus being the carrier of the virus of oriental sore and of the lizard (*Tarentola mauritanica*) acting as a reservoir. It is pointed out that in North Africa there are two centres, Biskra and Bon-Anane, where oriental sore is common but that sporadic cases occur throughout North Africa. If Phlebotomus, which is widely distributed in North Africa, is the carrier of the disease then some other factor must explain its much greater frequency at Biskra and Bon-Anane. Either some particular species of Phlebotomus alone is involved or there is some reservoir host which is limited especially to these districts. It appears that the large Phlebotomus belonging to the *papatasii* group feed almost exclusively on man while those of the smaller group—the *minutus* group—feed both on man and reptiles. This being so, it is strongly suggested that some reptile will play the rôle of the reservoir host of the *Leishmania tropica.*

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*Georgewitch (Jivoïn). Sur un trypanosomide nouveau, *Crithidia simuliae*, N. sp. d'une Simulie (*Simulium columbacensis*) de la Serbie septentrionale.—*C. R. Soc. Biol.* 1909. Vol. 67 (2e semestre) pp. 480–482. With 1 text fig.

Sur le Développement de *Crithidia simuliae*, N. sp.—*Ibid.*, pp. 517–519. With 1 text fig.

†Wenyon (C. M.). Note on the Occurrence of Herpetomonas in the Phlebotomus of Aleppo.—*Jl. London Sch. Trop. Med.*, 1912. Vol. 1, p. 98.

At Biskra the lizard (*Tarentola mauritanica*) is very common and is fed upon by the small Phlebotomus (*P. minutus* var. *africanus*) of this region. It feeds also upon man but seems to prefer the diet of reptilian blood.

An investigation of the lizards was undertaken, and in 1913 an examination of 319 captured at Biskra was made. A large percentage (44·82) of the lizards harboured haemogregarines. In 5·01 per cent. *Trypanosoma platydactyli* Catouillard, 1909, was found while in 7·34 per cent. there occurred filaria embryos, especially in the lungs. Material from the livers of 219 of these lizards was inoculated on to N.N.N. medium and cultures were obtained in 61 cases—28 times a culture of a leptomonas, 26 times a culture of the trypanosome and 7 times a mixed culture of both these.

In the cultures the leptomonas is shaped like a candle flame and has a rigid body 9–15μ in length with a flagellum either shorter or longer than the body from the blunt end of which it arises. In a single culture tube the growth will last for two months, when recognisable forms of the flagellate disappear. The authors compare the cultural forms with the leptomonas found by Wenyon in the Phlebotomus of Aleppo. This leptomonas has a body 15-25μ in length and is thus larger than the leptomonas cultivated from the liver of the lizards. There is no possibility of confusing the culture of *Trypanosoma platydactyli* with the leptomonas culture, which remains true to type exactly like the culture of *Leishmania tropica*. Experiments have been made by inoculating three men in the skin with cultures of the lizard leptomonas. Monkeys and mice have also been inoculated, the latter either intravenously or intraperitoneally. Control mice were inoculated at the same time with cultures of *L. tropica*. Four months later of 27 mice inoculated with cultures of the lizard leptomonas two showed in the liver or spleen bodies which might possibly be leishmania forms. Culture on N.N.N. medium was negative. Of the control mice inoculated with cultures of *L. tropica* from the Biskra oriental sore 5 had a generalized infection with leishmania. The experiments on the men and monkeys are not yet complete.

By way of controlling the results obtained in the endemic areas the lizards in other districts were examined. At Beni-Ounif-de-Figuig, where oriental sore does not occur, of 203 Phlebotomus caught only one was *P. minutus* var. *africanus*. Of 6 lizards examined culture of leptomonas was obtained from the livers of two.

Reference is made to the parasite found by Chatton and Blanc in the Gecko (*Tarentola mauritanica*) of Metlaoui (Tunis). These are leishmaniform bodies which occur in the red blood corpuscles. It may be these structures which have given rise to the cultures of leptomonas. Another parasite found by Chatton and Blanc, a protoplasm-like organism, called by them *Pirhemocyton tarentolae*, occurs in the Tarentola of Biskra (11 cases of infection out of 319 examinations) whereas the leishmaniform bodies were not found in the lizards of Biskra.

This line of research was interrupted by the war but the authors hope that more favourable circumstances will see a continuation of the interesting investigation.

C. M. W.

Medical Missions in India. 1915. Apr. Vol. 21. No. 81. pp. 14–17. —**Symposium : Oriental Sore.**

The several speakers gave their experiences in the treatment of this disease. In no case was the diagnosis confirmed by the microscopic finding of leishmania. The consensus of opinion was that treatment was best carried out by extensive scraping followed by the application of some antiseptic ointment or lotion. In one case scarlet ointment made from scarlet red (Amido-azotoluol-azo-Beta-naphthol) was recommended.

C. M. W.

Migone (L. E.). i. **Buba, or Leishmaniasis americana, in Paraguay.**— *Trans. Soc. Trop. Med. & Hyg.* 1915. June. Vol. 8. No. 7. pp. 219–225.

ii. **Further investigations on the Etiology of Leishmaniasis americana.**— *Loc. cit.* pp. 226–228.

i. During recent years a disease called buba has appeared in the north of Paraguay, among the native workmen in the large industrial establishments of these regions, in the Yerba Maté plantations, and in the lumber forests. The condition is an ulcerating affection of a chronic nature and slow development, which attacks the uncovered parts of the body—the feet, the legs, the arms, neck and face—and later invades the mucous membranes of the nose, pharynx, larynx, palate and lips. This disease has very likely spread to this country from the neighbouring state of Brazil, where it has long been known to exist. It has spread in Paraguay to such an alarming extent that in those districts which are infected hardly a house can be found in which one or several cases of the disease do not exist. The disease has been observed in natives of the country and in foreign residents, in men and in women, in the old and in infants at the breast. In certain districts it has caused terrible havoc. Of one hundred workmen who entered the woods to work, seventy to eighty had to leave within two months owing to the development of ulcers, in many instances in large numbers spread all over the body. The disease, which has been confused with syphilis, leprosy, sporotrichosis, cancer, yaws, etc., is now known to be a leishmaniasis. The disease begins generally with one or more erythematous papules which are very itchy, as if they had been caused by the bite of some insect. Two or three days later one or more of these papules become purulent, the pustule being about the size of a pin's head. When the pustule bursts, as it soon does, it leaves a small hole from which there exudes a sticky, serous fluid which on coagulating forms a dark greyish scab.

It is generally believed that the initial lesion has been caused by ticks but the author states that he has seen sores develop at the site of mosquito or horsefly bites or even at some point of traumatic abrasion of the skin. The ulceration extends while the surrounding skin becomes somewhat oedematous. From the ulcers there originates a lymphangitis, the affected lymphatics forming hard reddish cords and if these are pressed in the direction of the sore there exudes a seropurulent discharge. Here and there on the affected lymphatics are found hard nodules which later burst and form new ulcers. The

ulcers often heal in seven or eight months. The lymphatic glands are large and painful and after recovery they do not regain their natural size. In five or six months from the original inoculation and the appearance of the primary papule there begin to appear the lesions of the nasal and pharyngeal mucosa. These mucosal lesions may appear two or three months after the cicatrization of some quite insignificant sore on the skin. The whole naso-pharyngeal mucosa becomes involved, the septum is destroyed, while ultimately the outer nose, the skin over the cheek bones and the lips become involved, thickened and replaced by granulating masses which are either moist or dry. Ultimately the isthmus of the fauces gets blocked up while the pharynx and larynx become occluded so that speech and nutrition become impossible. The teeth become attacked with a periostitic infiltration and a secondary alveolitis though in the most advanced cases lesions of the tongue or digestive organs or true osseous lesions are never seen. The patients may live ten, fifteen or twenty years, the infiltration gradually extending to the bronchi until septic fever, malnutrition and exhaustion end in death. Leishmania are always to be found in the lesions though more readily in the early than in the chronic conditions.

Treatment in the early cases is comparatively easy—caustics, thermo-cautery, with potassium iodide and arsenic by the mouth. In advanced cases the treatment is very difficult though extensive cauterisation with the actual cautery and " 606 " have given good results, but the treatment must be repeated on three or four occasions. When the disease has invaded the mouth and nose it is very intractable. Improvement, however, has followed the use of hectine, " 606," orsudan, soamin, etc., but the resulting cure is slow and has to be supplemented by local caustics.

ii. The second paper is chiefly a discussion of a contribution by Brumpt and Pedrosa on the subject of the most probable carrier of the disease in Brazil. The paper was reviewed in this *Bulletin*, Vol. 3, p. 140.

In a discussion following upon the reading of the papers by Migone Dr. Low points out that no mention is made of injections of antimony tartrate, a line of treatment which several observers in South America have found to yield very encouraging results.

C. M. W.

Laveran (A.). **Nouvelle contribution à l'étude des infections expérimentales de la souris par la** *Leishmania tropica.*—*Bull. Soc. Path. Exot.* 1915. June. Vol. 8. No. 6. pp. 363–369.

This paper contains the results of further experiments by the author on the effects of inoculating mice with the parasite of oriental sore. A review of his earlier results will be found in Vol. 4, p. 401 and Vol. 5, p. 277 of this *Bulletin.* In all 36 mice have been inoculated with *Leishmania tropica* of Tunisian origin. In only six instances was the result negative, a fact due in these cases to a late examination, the animals having most probably recovered from an earlier infection. All the infected mice developed localized skin lesions while in the males

there developed tumours of a new growth which enveloped or even invaded the testicles. In only eight instances was the local infection attended by a generalized distribution of the parasites as judged by examination of the spleen, liver and bone marrow and in only one of these could the general infection be described as large. On comparing the enormous numbers of leishmania in the local lesions the impression gained is that the general infection is in reality of a secondary nature and not comparable with that seen in infections with *L. donovani* or *infantum*.

The testicular tumours which appear in the male mice have been examined in section. In one mouse the change was limited to the connective tissue surrounding the organ, which itself appeared normal. The fibrous capsule of the kidney was, however, involved at one point. The change observed was in the form of a deposit of embryonic elements in the connective tissue, which contained large numbers of leishmania. In a second mouse the condition was more pronounced, there being some tendency towards atrophy of the testicular tissue, while one testicle was actually invaded by the new growth deposit. In a third animal the new growth had produced marked degenerative changes in the testicle, due probably to pressure and to an invasion between the tubules of the testicle and also into the capsule of the organ. Leishmania were only to be found in the cells of this new growth and never in the tubule cells.

The animals have a tendency to the development of superficial abscesses and these when opened are found to contain a purulent fluid containing enormous numbers of leishmania. In other cases the abscesses are of a septic nature and bacteria only are to be found in them. In another mouse there was an arthritis due to invasion by the leishmania, for a puncture of a tibio-tarsal joint produced a thick fluid in the smears of which were found leishmania in extraordinary numbers.

The paper contains a detailed history of six mice. The animals were inoculated either intraperitoneally or subcutaneously with cultures of *Leishmania tropica* or parasites obtained from the broken up testicle of a previously infected animal. The mice received as a rule several injections at intervals of a week or more. Some animals were only inoculated once with a virus rich in leishmania. The lesions appear to be well developed after about a month while the animals were killed for examination after two or three months.

As a result of his experiments the author finds that the infection produced by *Leishmania tropica* in mice differs in its results from that produced by *Leishmania donovani* and *Leishmania infantum*. The former gives rise to lesions of the skin and a subsidiary general infection while the latter produces no skin lesions but only the generalized infection as in kala azar.

C. M. W.

Giugni (Francesco). **La riproduzione della leishmaniosi cutanea nella scimia da un caso di bottone d'Oriente osservata in Italia.** [The Infection of a Monkey with Cutaneous Leishmaniasis from a Case of Tropical Sore in Italy.]—*Pathologica.* 1915. May 15. Vol. 7. No. 157. pp. 237–238. With 2 figs.

The author describes a case of oriental sore in a girl aged nine years from Reggio Calabria in Italy. A monkey (*Macacus sinicus*) was inoculated from the sore on the child's chin in the left frontal region. It developed an oriental sore at the site of inoculation 67 weeks later though no sore developed on the right side, where it had been inoculated with a culture of *Leishmania tropica* from another case of oriental sore.

C. M. W.

i. da Matta (Alfredo A.). **Leishmaniose cavitaria.** [Leishmaniasis of the Buccal Cavity.]—*Brazil Med.* 1915. Mar. 8. Vol. 29. No. 10. pp. 73–74.

ii. Torres (Octavio). **O valor do tartaro emetico na leishmaniose. Tres observações.** [The Benefit of Tartar Emetic in Leishmaniasis; Three Cases.]—*Ibid.* Apr. 1. No. 13. pp. 97–101.

iii. Borja (Antonio) & Amaral (Afranio). **Contribuçao ao tratamento da Leishmaniose cutanea-mucosa pelas injecções endo-phlebicas de emetico.** [A Contribution to the Treatment of Muco-Cutaneous Leishmaniasis by Intravenous Injections of Tartar Emetic.] - *Arch. Brasil. Med.* 1915. Feb.-Mar. Vol. 5. No. 2–3. pp. 145–154. With 3 plates.

i. A case of leishmaniasis of the right nasal passage in a woman 40 years of age, with the further complication of a similar ulceration in the vulva. The parasite was recognized in smears made from both lesions. Treatment with Vianna's tartar emetic solution [see this *Bulletin*, Vol. 5, p. 269] was initiated, but the patient succumbed to an intercurrent thrombosis of the cerebral sinuses.

ii. Three more cases of the same kind, of which one was perfectly cured at the time of writing, while the other two showed marked improvement.

iii. Seven more cases of the same affection similarly treated. The plates give good photographs of the lesions.

J. B. Nias.

YELLOW FEVER.

KERR (W. M.). **An Account of the Yellow Fever which prevailed on board the United States Ship "Jamestown" in 1866-67 at Panama, as told by Delavan Bloodgood, A.M., M.D., Surgeon, United States Navy.**—*U. S. Naval Med. Bull.* 1915. Jan. Vol. 9. No. 1. pp. 82–110.

The writer of this paper has reproduced the account of the outbreak of yellow fever which occurred in the U.S.S. "Jamestown" in 1866–67, which was then acting as hospital and store ship at Panama. The story, as told by Dr. Bloodgood, now reposes in a musty volume of Medical Essays compiled from reports by the medical officers of the navy and published in 1872. It is of much interest and affords a glimpse of the distant days of sailing ships and long voyages, when ventilation, food and water supply and the means of caring for the sick were not of the best when judged by modern standards. Those who wish to realise how different are the conditions now prevailing under modern prophylactic measures can do no better than read the story of this fearful outbreak of yellow fever.

C. M. W.

PALACIOS (G. Delgado). **Why Yellow Fever is Endemic in the Tropical and Atlantic Region.**—*Med. Rec.* 1914. July 25. Vol. 86. No. 4. pp. 150-152.

Reference is made by the author to his earlier researches on a substance—cholerythrogen—which he has found to occur in the intestines and urine of people living in tropical and Atlantic regions where yellow fever is endemic. This substance associates itself with the urobilinogen and lime to form granular concretions similar to the ordinary intestinal sand which the author calls carcoma on account of its resemblance to the dust made by the wood-louse. The substance cholerythrogen appears to replace the uroerythrin of the temperate zones. The author further states that this substance is deposited in granules in the kidney, liver and spleen of cases of yellow fever—granules which have hitherto been supposed to be of the nature of melanin but which he has proved by a series of tests to be true cholerythrogen. "Therefore," to use the author's own words, "the assistance of a substance of intestinal origin in the production of yellow fever in its most dreadful manifestations must be considered as an established fact." The substance appears to be formed in the intestine by the action of specific bacteria which grow in the tropical and Atlantic region.

In the case of yellow fever it is not possible to establish what relation exists between the climatic substance of bacterial origin and *Stegomyia fasciata* but "the fact that this mosquito grows near human habitations and the observation of Reed, whose success was greatest when he added faecal matter to his breeding jars, are very suggestive."

C. M. W.

Seidelin (Harald). **Notes on the Pathology of Yellow Fever in Guinea-pigs.**—*Jl. Path. & Bact.* 1915. Jan. Vol. 19. No. 3. pp. 317–320. With 2 plates.

The author has made a detailed study of the histological changes undergone by the organs of guinea-pigs supposed to be suffering from yellow fever, some of which were infected by inoculation of blood, others by means of infected mosquitoes. The spleen, which is not enlarged, shows marked erythrophagocytosis and more or less intense pigmentation. One and the same phagocyte often contains erythrocytes, fragments of red cells and pigment. The author thinks that the lesions here described may be of importance for a better understanding of the pathology of yellow fever. Thus the erythrophagocytosis and destruction of haemoglobin in the spleen and to a slight extent in the liver may assist us in explaining the jaundice.

In yellow fever in the human subject necrobiosis is probably the most important phenomenon observed in the liver. Rocha Lima (1912) has described a midzonal necrosis as characteristic of yellow fever, but the author considers that the observation cannot be accepted as final as he has not found it of constant occurrence, while Opie and Ogata have noted it in other cases of septic icterus. In the experimental animals the necrobiotic phenomena are most marked in the middle zones of the lobule, although on the whole they must be classified as focal rather than zonal.

The gastric, pancreatic and renal lesions are similar to those observed in human cases though less marked. Those who are interested in the subject of the histo-pathology of yellow fever in the guinea-pig must consult the original article for further details.

C. M. W.

Seidelin (Harald). **Division Forms of Parasites in the Organs of Guinea-pigs infected with** *Paraplasma flavigenum.*—*Jl. Path. & Bact.* 1915. Jan. Vol. 19. No. 3. pp. 338–340. With 1 plate.

The author describes certain elements which have been observed in impression-specimens from the spleen, liver, kidney and lung of guinea-pigs which had been inoculated with yellow fever virus. These division forms of *Paraplasma flavigenum*, for such is the author's interpretation of their nature are, to begin with, intracorpuscular and the early stages may occur in the peripheral blood though always in small numbers. The earliest division form is larger than the ordinary peripheral blood form and has a more compact protoplasm. It leaves the erythrocyte but before doing so its chromatin may divide into two or four particles. In the following stage eight more or less definite elements appear, which are either irregularly ovoid, pyriform, or even vermicular, each one consisting of chromatin and protoplasm. Further division results in the formation of sixteen or more elements, the extreme minuteness of the objects now making it impossible to determine their exact number.

The possibility of their relationship to the *Pneumocystis carini* or lung parasite of the guinea-pig is discussed and the author admits the possibility of a mixed infection, though the presence of the bodies in other organs than the lung, their occurrence in a monkey inoculated

with blood containing *Paraplasma flavigenum*, and in specimens from yellow fever cases in man is distinctly against this view. In appearance they have the characters of Koch's " blue-bodies," the division forms of *Theileria parva.*

The author assumes that they represent a stage in the evolution of *Paraplasma flavigenum*—a form of multiplication which differs from the ordinary type of multiplication to be found in the erythrocytes of the peripheral blood. The author quotes Dr. Andrew Connal as being in agreement with him as to the nature of the bodies which form the subject of the paper. It is perhaps worthy of note that some of the guinea-pigs were infected by direct inoculation of the blood while others were infected by the bites of infected mosquitos.

[The author's interpretation of the appearances described above depends entirely on the views adopted as to the nature—parasitic or otherwise—of the bodies described by him as *Paraplasma flavigenum.*]

C. M. W.

Seidelin (Harald). **Intracorpuscular Bodies in Guinea-Pigs' Blood and Yellow Fever.**—*Jl. Trop. Med. & Hyg.* 1915. Feb. 15. Vol. 18. No. 4. pp 38–40.

Wenyon (C. M.) & Low (George C.). **The So-called Parasite of Yellow Fever.**—*Jl. Trop. Med. & Hyg.* 1915. Mar. 1. Vol. 18. No. 5. pp. 55–56.

These two communications call for no review as they contribute little to our knowledge of the subject under dispute. The former is a criticism of the paper noted in this *Bulletin*, Vol. 5, pp. 79–80, and the latter a reply to this criticism.

C. M. W.

Book Reviews.

Brazil (Vital). **La Défense contre l'Ophidisme.** (Traduction française par le Professeur J. Maibon.)—2ème Edition. 319 pp. With 28 plates. 1914. Saint Paul: Imprimerie Pocai-Weiss & C. Rua João Adolfo 60.

Although in this book the venomous snakes of the one country Brazil are the main theme, and the exposition of the nature of their venoms and antidotal sera alone is the chief purpose, yet the scientific and historic perspective are so well observed that the issue has an interest and a utility that are much more than local.

The subject is dealt with in three sections, of which the first treats of snakes and snake-venoms from a biological and physiological standpoint, the second discusses with some prolixity methods of preventing accidents from snakes, and the third is concerned both indirectly and directly with the treatment of snake-bite.

The first section embraces the natural history of the subject—the external features, dentition, anatomical characters, reproduction, habits, and classification of snakes. This is followed by an account of the *Colubridae* and *Viperidae* of Brazil, beginning with a brief notice of the harmless Colubrids, in which attention is chiefly directed, both by text and coloured figures, to those presumably useful species that feed upon their own kind, and to those that look like venomous species. Then the venomous snakes of the country are reviewed in detail, these numbering twelve species of *Elaps*—the only genus of venomous Colubrids occurring in America—and the same number of species of loreal-pit-vipers (*Crotalinae*), which are the only American representatives of the Viperidae. It is to these latter, which in Brazil comprise a single species of *Crotalus* and eleven species of *Lachesis*, that the author devotes most attention; all the commoner and more formidable species are fully described under their scientific and vernacular names, and are well figured in colour; their habits, haunts, and local distribution are advertised; and the obvious effects of their bites are impressively illustrated by authenticated tragedies.

In the author's experience the most dangerous of all Brazilian snakes is a Rattlesnake, *Crotalus terrificus*, which is very abundant in many parts of the country. Its venom is stated to be peculiar in having a selective affinity for the nervous system, and further in becoming to some extent provisionally locked-up in the blood of a victim, so that several days after the administration of appropriate antivenine has apparently ensured complete recovery this latent venom is suddenly released and causes a startling relapse; for this reason it is advised that any patient bitten by this snake should be kept under observation for 15 to 20 days after the initial treatment.

Other species at once common and dangerous are *Lachesis mutus* ("Surucucu,") *Lachesis lanceolatus* and *atrox* ("Jararaca," "Jararacuçu,") *Lachesis alternatus* ("Urutu," "Cotiara," "Cruzeiro,") and *Lachesis jararacucu*, which the author considers to be distinct from *L. lanceolatus*.

After a comprehensive account of the reptiles themselves, the chemical characters and the physiological and pathological effects of their venom are considered in detail. The historic observations and generalizations of workers in other countries are pertinently discussed, but the most valuable contribution is the author's own disquisition, systematic and comparative, upon the venoms of the Brazilian species. These venoms he groups in three series, namely (1) Elapine, causing marked paralysis, but little local reaction; (2) Crotalic, causing moderate local reaction, marked paralysis, and extraordinary visual disturbance; and (3) Bothropic (*Lachesis* venoms) causing intense local reaction and great haemolysis and proteolysis, but having no action upon the nervous system; another feature of *Lachesis* venoms is that doses below minimum lethal standard have very little toxic effect.

If the second section, entitled Prophylaxis, may seem unduly formal, its justification may perhaps be found in the author's estimate that annually in Brazil nearly 20,000 accidents and nearly 5,000 deaths are due to venomous snakes. The facts that 60 per cent. of the bites are on the foot

and 13 per cent. on the leg are evidence that in Brazil, as in India, the lack of foot-gear and of money to buy it is the main impediment to security. The author enumerates all the natural enemies of snakes, and holds in very high regard the "Mussurana," *Oxyrhopus cloelia*, a harmless Colubrine, which is said to feed exclusively on other snakes and to be addicted particularly to the venomous kinds, overcoming and swallowing them in a most heroic manner.

In the third section among other matters the methods of preparing antivenines at the Institute of San Paulo are fully described. The animals used are horses and he-mules, and the usual process of immunisation extends over a year. For procuring comprehensive immunity mixtures of different venoms are employed, standardized glycerine solutions of the clarified and dried secretion of the several commoner species forming the exact components of the mixtures. Four kinds of antivenines are issued from the Institute, namely, "antielapine," which is antitoxic to a mixture of the venoms of the different species of *Elaps*; "antiophidic," antitoxic to a mixture of the venoms of *Crotalus* and all the common species of *Lachesis*; "antibothropic," antitoxic to a mixture of *Lachesis* venoms alone; and "anticrotalic," antitoxic to *Crotalus* venom alone.

The whole range of treatment of snake-bite is also surveyed, from the sorcerer and the quack to serum-therapy. Surgical treatment and the use of the salts of manganese and of other chemical reagents are discussed, but not with much appreciation, the experimental work of Captains Acton and Knowles of the Indian Medical Service, which establishes the value under certain conditions both of ligature and of the injection of salts of manganese, having, no doubt, been published too recently for consideration in this edition. Bannerman's opinion, which the author quotes with approval, that the local injection of potassium permanganate is useless, does not justify the disavowal of every kind of treatment outside the line of antitoxins; for the careful and properly controlled experiments of Acton and Knowles show that an immediate local injection of 10 cc. of a 5 per cent. solution of zinc permanganate, or of gold chloride, alone may save a number of cases of cobra-bite, and still more of Russell's-viper-bite; and further, that the immediate application of an efficient ligature has saved life, in cases of Russell's-viper-bite, without other treatment. And in any case, even when a suitable antivenine is available, both measures are likely to diminish the amount of absorbed venom that has to be neutralised.

The worth of this valuable treatise is much enhanced by a bibliography, from which however some well known names and several classical references are missing. The names of Beaujan, D. D. Cunningham, and Gunn do not appear, and the references to the work of Fraser, Noguchi and Weir Mitchell are quite inadequate.

A. Alcock.

Bahr (P. H.). [M.A., M.D., D.T.M. & H. (Cantab.), M.R.C.P. (Lond.), M.R.C.S.] **A Report on Researches on Sprue in Ceylon 1912-1914.** —ix + 155 pp. With 8 plates. 1915. Cambridge: At the University Press. [Price 7*s*. 6*d*. net.]

Of tropical diseases there is hardly any one of which we are more ignorant of its true pathology than Sprue, and therefore the Committee of the London School of Tropical Medicine eagerly embraced the opportunity when it offered of sending Dr. Bahr to Ceylon to investigate it. He spent some fifteen months of 1912–1913 in that island of many climates, and wisely installed his laboratory in the hill resort of Nuwara Eliya, where the cooler air permits an European to work at any time of the year. From the laboratory it was easy to descend by bicycle or train to visit cases of the disease or to perform autopsies. In this way much valuable material was collected, which was then worked out in London at the Tropical School.

The monograph begins with a short account of the island and the prominent types of its people. The Europeans, who number some 7,500, suffer chiefly from typhoid fever, amoebic dysentery, malaria and sprue. All the races represented in Ceylon are liable to sprue, but the imported European is specially susceptible. On the other hand, the author is convinced that the disease is of more common occurrence in native races than has hitherto been supposed by English observers. He saw eleven undoubted cases among native males, and 36 cases among Europeans, five of whom had always lived in Ceylon. Of the European patients, 19 were females and 17 were males, and additional proof that, among Europeans at least, women are specially susceptible, for there are twice as many European males as females in Ceylon. Though in five experiments on monkeys and guinea-pigs he failed to communicate the disease, the author is strongly of opinion that sprue is communicable in the family, and he quotes seven cases of apparent infection, which came under his own notice. Defining as complete sprue all cases with the characteristic tongue and faeces, he suggests that there are many clinical cases of two varieties of incomplete sprue, (1) where typical diarrhoea exists, but no tongue or mouth lesions, (2) where the changes are confined to the mouth and tongue. This last variety he calls "tongue sprue." If he is correct, and if flatulent dyspepsia, large, pale, frothy, acid stools and oesophageal irritation are no longer to be considered pathognomonic symptoms, it is clear that we must re-construct the definition of the disease.

After almost daily examination of the faeces of four patients during more than two months, he is of opinion that the loss of colour in sprue stools is due, not to absence of bile pigment, but to the reduction of the normal hydrobilirubin to the colourless leucourobilin. The average weight of a daily sprue stool varied from 56 to 901 grammes, while evidence showed that there was a diminution or absence of the pancreatic ferments. In every sprue patient examined, and especially in those in whom tongue symptoms predominated, the saliva presented a marked acid reaction to litmus paper. He could not discover any essential difference between the microscopical structure of the sprue tongue and that of an infant's tongue affected by the thrush fungus. He inclines to the view that the pathology points to an infection with the thrush fungus, *Monilia* (*Oidium*) *albicans*, as the cause of sprue. In six sprue spleens he found hyaline, Gram-positive, not acid-fast bodies in the endothelial cells, and he failed to find these bodies in 43 spleens where the cause of death was dysentery, ankylostomiasis, undetermined diarrhoea, malaria, kala azar, pernicious anaemia, tuberculosis, etc. He suggests that these new bodies are possibly a degeneration produced in response to the extensive yeast infection, but he modestly acknowledges that it is as yet unproven whether the bodies represent a degeneration pathognomonic of sprue. In acute sprue and in the final stages of the disease the most prevalent organisms in scrapings from the tongue, in saliva and in stools are yeast colonies of which the author examined 112 cultures obtained in Ceylon; all but six of these belonged to the genus *Monilia*.

There is nothing new in the treatment advocated, except that bael fruit (*Aegle marmelos*) is highly praised, especially when given raw. Three cases of sprue diarrhoea were empirically treated for a time with emetine injections, but without avail.

To this useful monograph are appended a list of references, interesting details of cases and some excellent water colour sketches, for the author has the great advantage of being an artist.

F. M. Sandwith.

LIST OF REFERENCES.

[Continued from BULLETIN, Vol. 5, pp. xlix–lxxiv.]

For the benefit of recipients of the Bulletin who wish to make a **Card Catalogue,** or to preserve a consecutive record of the references on any subject, **galley proofs** [' *Korrekturbogen* ' ; ' *Première* '] of the **Quarterly Lists of References** (printed on one side of the page) can be supplied at the subscription price of **Two Shillings** per annum. They are obtainable from the beginning of 1914 onwards. Application should be made direct to the Bureau.

AMOEBIASIS (including Entamoebic Dysentery and Liver Abscess).

ACHARD (Ch.) & FOIX (Ch.). Deux Cas d'Amibiase Hépatique en Foyers disséminés avec Cirrhose Hypertrophie.—*Arch. de Med. Experim. et d'Anat. Path.* 1914. July. Vol. 26. No. 4, pp. 345–365. With 3 figs.

BEACH (W. M.). The Medical and Surgical Treatment of Amebic Dysentery.—*Trans. Am. Proctol. Soc., St. Louis,* 1914. Vol. 16. pp. 86–94. [*Index Medicus.*]

van den BRANDEN (F.) & DUBOIS (A.). L'Amibiase et son traitement par l'Emétine à l'hôpital des Noirs, Léopoldville, Congo Belge.—*Bull. Soc. Path. Exot.,* 1915. May. Vol. 8. No. 5, pp. 332–338.

CORLETTE (C. E.). Amoebic Dysentery and Abscess of Liver: An Indigenous New South Wales Case.—*Med. Jl. of Australia.* 1915. May 8. Vol. 1. [2nd Year]. No. 19, pp. 427–428.

FLANDRIN (C.). La dysenterie amibienne et son traitement.—*J. de Med. et Chir. Prat.,* 1914. Vol. 85. pp. 561–569. [*Index Medicus.*]

GREIL (G. J.). Report of a Case of Ameba Colitis in a Child of Five Years of Age.—*Arch. f. Pediatrics,* 1915. Apr. Vol. 32. No. 4. pp. 272–273.
[Case as stated in title. Successfully treated by Emetine.]

LYONS (Randolph). Mode of Action and Use of Emetin in Entamoebiasis. —*Amer. Jl. Med. Sci.,* 1915. July. Vol. 150. No. 1. pp. 97–109.

MARSHALL (D. G.). Primary Malignant Adenoma of the Liver simulating Tropical Abscess.—*Edinburgh Med. Jl.,* 1915. July. New Ser. Vol. 15. No. 1, pp. 29–31. With 1 plate.

MINK (O. J.). Salvarsan in a Case of Amebic Dysentery.—*U.S. Naval Med. Bull.,* 1914. Oct. Vol. 8. No. 4, pp. 653–654.

PASLEY (Claude Burgoyne). Two Extraordinary Cases of Liver Abscess.— *Lancet.* 1915. May 22. pp. 1076–1077. With 3 figs.

PHILLIPS (Llewellyn Powell). Amoebiasis and the Dysenteries.—xi + 147 pp. Demy 8vo. 1915. London: H. K. Lewis.

ROGERS (Leonard). Pyorrhoea Alveolaris as a Streptococcal and Amoebic Disease and its Treatment by Vaccine and Emetine.—*Indian Med. Gaz.,* 1915. Apr. Vol. 50. No. 4, p. 121.

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[A Burman at Port Blair, who was believed to have died from eating the globe fish (*Tetrodon*), a photograph of which is given.]

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